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Predicting Success in Teaching

A random sample of 60 graduates of the Simon Fraser Professional Development Program was used to study predictors of success in professional teaching. The criterion variable "success" was defined as the level of teaching performance as rated on a five-point scale by supervisors in school systems. The predictor variables found to be most closely correlated with success were (1) the student teachers' grade in Education 405, a 16-week experience in the classroom; and (2) the students' matriculation (grade 12) average. By means of a step-wise regression analysis it was possible to develop a predictor equation. The multiple correlation coefficient between predictors and criterion after appropriately weighting the three best predictors was found to be .49.

Over the years researchers have attempted to identify human traits and abilities useful in the prediction of success in teaching. They argue that if these qualities are identified, the selection of candidates for teacher education would become a much more systematic and efficient process. Commissions on education, without fail, emphasize the prime importance of establishing reliable criteria for teacher selection. Two reports from different sections of Canada state:

> Universities should adopt a screening policy for applicants to the teaching profession. Even more important than academic qualifications is the ability to relate to people. (Commission on Education, British Columbia Teachers Federation, 1968); and
>
> The committee is convinced that improvement in the selection and education of teachers is fundamental to the improvement of education in Ontario. (Hall-Dennis Report, Ontario Department of Education, 1968.)

Approaches to Predicting Success

At a time when teacher supply is catching up with demand, the above recommendations take on new significance. It is proposed in this paper

to consider two approaches to the problem of predicting success in teaching:

1. the traditional approach which has been an attempt to identify those human traits and qualities which are likely to lead to success, and

2. the approach being used at Simon Fraser University which is to augment the traditional approach through the identification of individuals who are likely to succeed. This identification comes reasonably early in the Professional Development Program, so that those unlikely to succeed may opt out without great loss of time or money.

Personality and Attitude Measures

Numerous attempts have been made to systemize the process of predicting success in teaching by means of measures of the individual's personality and attitude. These have had two definite limitations: (1) they attempted to predict success in *student* teaching, not in *professional* teaching; (2) few significant correlations were found.

Michaelis (1954), using 271 student teachers as subjects, completed a comprehensive study at the University of California entitled "The Prediction of Success in Student Teaching from Personality and Attitude Inventories." Instruments used in the study included the Minnesota Multiphasic Personality Inventory, The Heston Personal Adjustment Inventory, The Minnesota Teacher Attitude Inventory, The Minnesota Personality Scale, and The Minnesota Thinking—Social—Emotional—Inventory. Having done an extensive analysis of the correlations between personality variables and student teachers' performance, Michaelis was forced to conclude that *no* combination of the sub-tests employed in the study was found to have sufficient predictive efficiency to warrant its use in a selection program designed to identify the best and the poorest student teachers.

Similar disappointing results were obtained with the Minnesota Teacher Attitude Inventory by Sangren and Schmidt (1956) who, using 393 student teachers as subjects, found that scores on the instrument bore no relationship to supervisors' evaluations of teaching performance. Durflinger (1963), using the Psychological Examination of the American Council on Education, obtained correlations of -.08, -.13, and -.13 when quantitative, linguistic and total scores were compared with supervisors' ratings of student teachers. Burkard (1965), again using the MTAI, found it unreliable as a predictor of teaching effectiveness. An interesting question is why such studies continue to be done when there have been so many disappointments.

A slightly different approach described by Gough (1968), suggests that an assessment of "folk dimensions" of interpersonal and interactional behavior may be more useful in predicting teaching performance that the traditionally-used psychological dimensions. Scores on the California Psychological Inventory, an instrument developed by Gough, were obtained for 298 student teachers and these were compared to ratings assigned by their supervisors. By means of a step-wise regression analysis, those psychological variables with the higher predictive Beta weights were obtained. These were: psychological mindedness,

achievement-via-conformance, socialization, good impression (negative predictor) and flexibility (negative predictor). A regression equation using these five predictors was developed which provided scores correlating at the +.36 level with the criterion variable, student-teacher performance.

Having obtained this modest predictor, the next step was to describe, in everyday language, the personal qualities of those scoring well on the C.P.I. To do this, each subject was rated by five of his peers on the Adjective Check List (Gough and Hillbrun, 1965). It is interesting that a slightly different configuration of common personality traits appeared for males who scored high on the C.P.I. than for females. A summary of these qualities is presented in Table 1.

TABLE 1
TERMS USED MOST TYPICALLY BY STUDENT-TEACHERS IN DESCRIBING THEIR PEERS

Male Students		Female Students	
Scoring High on the C.P.I.	Scoring Low on the C.P.I.	Scoring High on the C.P.I.	Scoring Low on the C.P.I.
conscientious	reckless	dominant	curious
practical	daring	persevering	affectionate
rational	pleasure-seeking	persistent	careless
moderate	spendthrift	serious	easy-going
methodical	irresponsible	opinionated	unconventional
planful	flirtatious	ambitious	dreamy
responsible	show-off	demanding	understanding
logical	spontaneous	logical	irresponsible
reasonable	adventurous	rigid	cheerful
capable	mischievous	clear-thinking	natural
thorough	quick	determined	individualistic
reserved	careless	responsible	thoughtful

Note—Terms are listed in descending order of frequency.

This summary, would suggest that the male scoring highest on the C.P.I. is a diligent, well-organized, conscientious individual who is attentive to the practical demands of his work and can be counted upon to display discretion and good judgment. In the case of the female, the emphasis appears to be more upon her drive, resolve, firmness and her recognition of need for insightful and responsible behavior. Although this high-scoring female might appear to her colleagues to be somewhat dogmatic and inflexible, these same qualities may well be viewed by her pupils as decisiveness, clarity and the condition of being well organized.

Whether Gough's research findings will be useful in selection of teachers will depend upon repeated testing and replication. Meanwhile, his claim is that the "verbal portraits" above possess more reliability in prediction than the traditional psychological inventories.

Simon Fraser Program in Professional Development

As a consequence of the limited success thus far experienced in identifying personality *traits* useful in prediction, the Simon Fraser Program in Professional Development has focussed attention upon the identification of the *individual* likely to be successful. The author has made an attempt to assess some of the outcomes of this model, in use since 1965.

The assumption is made at Simon Fraser that in the selection of teachers, one can not completely rely upon academic records, personality inventories and pre-admission interviews. Although these criteria are useful, many persons will enter the Professional Development Program who are not suited to the teaching profession and will not be happy or successful in it. Consequently there should be ample opportunity for the individual to determine his suitability for the profession well in advance of the time when a decision must be made regarding his certification.

There are a number of ways in which this is achieved. Before the student is admitted, not only are the usual academic records scrutinized, but he is also asked to describe his reasons for wishing to become a teacher and to indicate prior experiences which relate to child care, supervision of children's playgrounds, tutoring, etc. In many cases, where the standard criteria are borderline, experiential criteria may be the deciding factor.

When the student is admitted he is immediately sent to a school as part of a team of three or four students where he assumes a small share in the responsibilities and challenges of the classroom. This portion of the program, Education 401, continues for eight weeks and is followed by another eight-week period, Education 402, of on-campus study. During the following sixteen-week period, Education 405, the student is again in the classroom, not as part of a team but as an individual who will during that time come to assume a large share of the teaching responsibilities. Another sixteen-week semester of study on campus, Education 404, completes the Professional Development Program. It is believed that during these several phases it is possible to predict with reasonable accuracy the criterion variable, success in teaching.

Research Problem

Studies which were reviewed in the first section of this paper used as their criterion variable, success in student teaching. The report which follows goes one step beyond this, to consider success in *professional* teaching. (It should be pointed out that data related to success in professional teaching are difficult to obtain since persons in administrative or supervisory roles hesitate to release such data even though complete confidentiality is assured.)

The study involved the identification of predictors of success in teaching and to rate these in terms of their predictive efficiency. The predictors were:

1. junior matriculation average,
2. grade point average in university courses prior to entering the

Professional Development Program, (two years of university education is minimum for entry),

3. standing in Education 401, (first eight weeks of program—in schools),

4. standing in Education 402, (following eight weeks, on campus),

5. standing in Education 405, (following sixteen weeks, in schools on an individual basis),

6. standing in Education 404, (following sixteen weeks, on campus; some students take Education 404 before Education 405).

The criterion variable was success in professional teaching as rated on a five-point scale by supervisors in the British Columbia school system.

The sample consisted of a random selection of 60 students who had graduated from the Simon Fraser Professional Development Program during the period 1966-1968, and who were, in 1969, teaching in B.C. schools.

Table 2 suggests that there are at least three predictors which might be used in combination to develop a more effective combined predictor of the variability of success in teaching. A stepwise regression analysis (Draper and Smith, 1966) was then applied to the data to determine how much of the variance of the criterion could be predicted using a combination of the independent variables.

TABLE 2
CORRELATIONS OF INDIVIDUAL PREDICTORS WITH TEACHING SUCCESS

Predictor	Correlation with Rated Success in Professional Teaching (N=60)	Significance Level
Junior Matriculation Average	.3107	.05
Grade Point Average (at University, prior to teacher education)	.2060	N.S.
Education 401 (8 week program in classroom, in teams)	.0188	N.S.
Education 402 (8 week program on campus)	.0594	N.S.
Education 405 (16 week program in classroom, Individual)	.3338	.05
Education 404 (16 week program on campus)	.0835	N.S.

Three of the predictors appeared to be the principal ones accounting for the variance in teaching success. In the stepwise regression pro-

cedure the best predictor is selected first and is followed by the one which accounts for the next highest amount of remaining variance, and so on. Table 3 records the variance accounted for by the three best predictors, viz., Education 405, Junior Matriculation Average and Education 401, 402, 404 (combined).

It is interesting to note that in this analysis, grade point average at university (prior to the Professional Development Program) does not appear as a prime predictor, even though Table 1 shows it to have a correlation with the criterion variable which is just short of the significant level. One explanation for this is that Junior Matriculation Average, which is a better predictor, is selected first in the analysis and has subsumed much of the variable of academic competence contained in university G.P.A.

TABLE 3

BEST COMBINATION OF PREDICTORS OF SUCCESS IN TEACHING (N=60)

Predictor	Per Cent of Variance in Criterion Accounted For
Education 405 (16 week program in classroom, individual)	11.14%
Junior Matriculation (Gr. 12) Average	9.32%
Education 401, 402, 404 (combined)	3.81%
Total Variance Accounted For:	24.27%
Multiple correlation coefficient for the above three predictors:	.4926[1]

[1] Significant at the .001 level.

Implications for Teacher Education

Findings from this study lead one to question some current beliefs about teacher education and to support some others.

The practice of grouping student teachers in teams when they are placed in classrooms has many advantages, but predictability of ultimate success is not one of them. Correlation between the performance of students in this situation and their ultimate performance is close to zero. By contrast, the ratings students receive when assigned *individually* to classrooms (Education 405) correlate at a higher level with ultimate teacher performance than any other predictor considered ($r = .33$). One might conclude that when a student is placed in a classroom, as a member of a group, his opportunity to perform is limited and his visibility low. Any assessment of his potential as a teacher, in this situation, would appear to differ little from a chance assessment. However, when there is a one-to-one relationship between student teacher and professional teacher, over an extended period, the assessment of his performance is

a respectable predictor of ultimate success. This finding lends empirical support to such statements as the following by MacDonald (1970): "Teacher education must cease to be the exclusive responsibility of universities and colleges and become the overt concern of the whole educational system (p. 17)."

The second best predictor of success in teaching was found to be the Junior Matriculation (Grade 12) average, (r = .31). This is not surprising since the grade twelve curriculum and its related evaluation procedures tend to be somewhat standardized within provinces and between provinces in Canada. It could be said that persons who have learned to accommodate to the educational system as students will readily accommodate to the system as teachers. This is not to say that these people are necessarily conformists, but rather that they are able to co-operate with others in an enterprise which has both individual and organizational objectives. It is well documented that the "best single predictor of success in University is the high school average (Lavin, 1965)." Thus, one would be surprised if this study had not confirmed the matriculation average as the best predictor among scholarship variables.

The results of this study must be viewed with caution since they are based upon correlational, not experimental investigations. Any conclusions drawn should be stated as correlations between variables rather than as cause-and-effect relationships. Within these limitations what does the study suggest to those responsible for teacher education?

1. Personality variables, though generally considered important in teaching, have been difficult to identify and have not shown great promise as reliable predictors of teaching success.

2. "Folk dimensions" of interpersonal behavior, (Gough, 1968) may be more useful as a guide in the identification of prospective candidates for teaching.

3. The best "scholarship-type" predictor is the grade twelve average.

4. The best predictor of all appears to be the extended (16 week) experience in the classroom in which a student works closely with a professional teacher and gradually assumes professional responsibility.

It now appears possible to develop through regression analysis a combined predictor, using personality, scholarship and experiential variables which will predict success in teaching with greater and greater reliability. If public education is to meet an ever-increasing societal obligation and challenge, an up-grading in the effectiveness (success) of the professional teacher is essential. Since teaching is a life-time career, the time to influence the quality of teaching in the year 2000 is now; one way to influence it is through a program of teacher selection and teacher education based upon what we do know, and can learn, about the predictability of teacher performance.

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Effects of Visual Discrimination Training on Immediate and Delayed Word Recognition In Kindergarten Children[1]

The study compared 20 groups of kindergarten children learning to read and to recall words following different kinds of visual discrimination training. Groups were designated by kind of training, kind of word, and sex. The kinds of training included same words as reading task, same letters which were constituents of reading words, different meaningful words (presentation of visual form, pronunciation, and picture) and combinations of same-letters and different-meaningful-words. Half the groups learned to read words similar in configuration and sounds; the others learned dissimilar words. Results of analysis of variance indicated no significant differences on immediate or delayed recognition task for kind of training or sex but kind of word was consistently significant. Similar words were more difficult than dissimilar words to discriminate, to learn to read, and to recognize later.

The present study is an extension and partial replication of the conditions that led to significant findings in four previous studies relating to the effects of various kinds of visual discrimination training on teaching children to read words.

In the first study (Muehl, 1960), three groups were given visual discrimination training with different symbols: words that appeared on a subsequent reading task, words that did not appear on the subsequent reading task, and geometric forms. The group that had been trained to discriminate among the same words that appeared on the reading task learned to read the words faster, but there was no difference between

[1] The authors wish to thank the Alberta Advisory Committee on Educational Research, the University of Iowa, and the participants in the study.

the different word and geometric form groups. This finding suggests that visual discrimination training should be closely related to the specific words to be learned in beginning reading.

Another study (Muehl, 1961) was designed to determine whether children were attending more specifically to the configuration of the word or the individual letters in the word. Specific letters were more important cues than the shape of the word in learning to read.

King's study (1964) contained a partial replication of Muehl's earlier studies using words and letters in visual discrimination training which were relevant to the reading task. In addition, training with different words that were meaningful was compared to the training with the same words and the same letters. Words were made meaningful to the child by the accompaniment of an appropriate picture and pronunciation with the visual form. The findings indicated that when various types of discrimination training are contrasted in terms of their effectiveness in helping children learn to read a list of words, training to respond to printed symbols as meaningful units and training to discriminate among letters appearing in the reading words were the most effective procedures.

In a subsequent study (King and Muehl, 1965), the effects of learning to read different kinds of words were investigated. Groups of words which were similar in configuration and contained some of the same phonemes were more difficult to learn to read than dissimilar words and appeared to interact with training conditions.

In all the above studies, the effects of various types of visual discrimination training were determined with a reading task that followed immediately after the discrimination training. What ever transferred to the reading task was recalled and applied on a short term basis. In a practical reading situation what is transferred and recalled over a long time interval is obviously of greater importance than what is effective in the short interval. What transfers immediately may be the same as that which transfers over a longer period or time or it may not. It is possible that visual discrimination training effectiveness may vary, given the time interval between that training and when the words have to be learned or recalled.

In addition to the recall factor, sex differences in reading achievement are apparent in performance on standardized reading tests, beginning as early as first grade (Bond and Dykstra, 1967). Although this difference exists there is little specific evidence to indicate what variables operate to produce the difference.

The present study was designed for two purposes: (1) to investigate further visual discrimination training procedures suggested by the earlier studies, and (2) to consider the relation of these procedures to recall, kinds of word, and sex differences. The following specific questions were posed:

1. If training children to respond to words as meaningful units and training in letter discrimination are equally effective in preparing children to read words, would a combination of these types of discrimination training produce an even greater facilitation?

2. If similarity among words is a factor that interacts with training for reading, would the differential effects appear if the training tasks are extended to cover words highly similar and dissimilar in visual and auditory forms?

3. Do the methods of visual discrimination training and the similarity of the words contribute to differential effects on a delayed recall task?

4. In what ways do the above factors relate to the sex of the subject?

Procedure

Design of the Study

The study was planned in three main parts: discrimination training, reading tasks, and recall tasks. Subjects were given different kinds of visual discrimination training prior to learning to read a common list of 4 words. A recall test on the 4 words used in the reading task was administered 24 hours later.

Five kinds of training were used in training subjects to read a list of 4 similar words. The same methods of training were repeated using different subjects learning to read a list of 4 dissimilar words. Each of these 10 groups was further divided into female and male groups making a total of 20 groups as shown in Table 1.

The main statistic used in analyzing the data was an extension of the Lindquist (1953) Type III analysis of variance. The between factors included kind of training, kind of word, and sex; the within factor included learning trials. Analyses were conducted on the number of correct responses on the training, reading, and recall tasks and on the errors and omissions on the reading and recall tasks.

Materials and Method

A kindergarten-sized table and 2 chairs were provided in a classroom apart from the regular classroom. A sloping wooden stand was placed on the table to hold the training and reading materials.

Training Tasks. Loose-leaf books, 8½ x 11 inches, were used in training and training familiarization. The pages were of heavy white paper, covered with acetate to protect them from handling. Training stimuli were presented halfway down on the left side of the page. Four response choices were presented on another page the same distance down, but in a position to the right of the stimulus. The response choices were enclosed in hinged acetate pockets with the correct choice indicated by a gold star underneath the pocket. A blank page appeared between the page with the stimulus and the one containing the response choices to provide for a successive method of presentation.

The stimuli used in familiarizing the subjects with the discrimination training were the same for all groups and consisted of geometric figures in outline: circle, square, triangle, and cross. One trial consisted of presenting each of the 4 stimuli and accompanying response choices. Subjects who did not make 4 correct responses on the second familiarization trial were eliminated from the analyses.

The training stimuli included: letters, words, words accompanied by pictures, and some combinations of these stimuli. Word and letter stimuli

were typed in lower-case letters on a primary typewriter. The pictures were outline drawings in black ink. All words selected contained 4 letters to hold the length constant. "Similar" words were chosen to pro-

TABLE 1

VISUAL DISCRIMINATION TRAINING GROUPS

Kind of Training	Kind of Word				Number of Trials
	Similar (S)		Dissimilar (D)		
	Female (F)	Male (M)	Female (F)	Male (M)	
Same-Word (SW) Words which are the same as reading words.	Group 1	Group 2	Group 3	Group 4	8
Same-Letter (SL) Letter constituents of reading words.	Group 5	Group 6	Group 7	Group 8	8
Different-Meaningful-Word (DMW) Words different from reading words. Presentation of appropriate picture and sound with visual form.	Group 9	Group 10	Group 11	Group 12	8
Same-Letter and Different-Meaningful-Word (SL+DMW) Training with same-letters for ½ trials followed by different-meaningful words for ½ trials.	Group 13	Group 14	Group 15	Group 16	4+4
Different-Meaningful-Word and Same-Letter (DMW+SL) Training with different-meaningful-words for ½ trials followed by same-letters for ½ trials.	Group 17	Group 18	Group 19	Group 20	4+4

vide words which were approximately the same in configuration and contained many of the same phonemes. In contrast, the "dissimilar" words were selected because of their differences in configuration and phonemes.

When the stimulus for a trial was a word or a word and picture, the response choices were 4 similar and dissimilar words appropriate to

the task. When the stimulus was a letter, the response choices were the letter constituents of the word appropriate to the task. Letters for the remaining words were presented in like manner. A total of 8 training trials was presented to each subject.

The words which were used both as stimuli and response choices for the Same-Word Groups were the words appearing in the reading and recall tasks: find, food, feed, foot for the similar words (Group 1 - female and Group 2 - male) and fork, gate, drum, nest for the dissimilar words (Group 3 - female and Group 4 - male). The letters which served as both stimuli and response choices for the Same-Letter Groups were the letter constituents of the words used in the reading and recall tasks. Because of some double letters in the similar words for 2 of the Same-Letter Groups (Group 5 - female and Group 6 - male), stimuli f, i, n, d; f, o, o, d; f, e, e, d; f, o, o, t were presented with the correct response and 3 other randomly selected incorrect response choices from the letters f, i, n, d, o, e, t. For dissimilar words in the Same-Letter Groups (Group 7 - female and Group 8 - male), the letter stimuli and response choices were f, o, r, k; g, a, t, e; d, r, u, m; n, e, s, t. In the Different-Meaningful-Word Groups, word stimuli were used which were different from the words to be presented in the reading and recall tasks: doll, ball, bowl, bell for the similar words (Group 9 - female and Group 10 - male) and hand, coat, girl, shoe for the dissimilar words (Group 11 - female and Group 12 - male). The visual form of these words was, in each case, accompanied by an appropriate picture and pronunciation of the word. The stimuli used for the Same-Letter Groups and the Different-Meaningful-Word training were combined in 2 sequences for the remaining groups. One sequence was the presentation of 4 training trials with Same-Letters followed by 4 training trials of Different-Meaningful-Words for the similar words (Group 13 - female and Group 14 - male) and for the dissimilar words (Group 15 - female and Group 16 - male). The other sequence was the reverse order of presentation of 4 trials of Different-Meaningful-Words followed by 4 training trials of the Same-Letters for the similar words (Group 17 - female and Group 18 - male) and for the dissimilar words (Group 19 - female and Group 20 - male).

A presentation consisted of the experimenter exposing a page which contained a stimulus for about 2 seconds. During this interval a marker was held above the stimulus to focus the subject's attention on it. He was told to look carefully at the stimulus. After the stimulus page had been turned over a blank page was shown for about 2 seconds. The next page contained the 4 response choices which were exposed for about 4 seconds. The subject was instructed to lift the word card that "looks just like" the one presented earlier. The 12 groups receiving all or part of their discrimination training using different-meaningful-words had additional instructions. When each word was presented an appropriate picture suggesting the meaning of the word appeared above the word. After about 1 second, the experimenter placed the marker over the picture to focus attention on the word and said, "Look carefully at this word. The word is _____." When the response choices were shown, the experimenter said, "Lift up the word card that says _____."

Within each trial for all groups, the order of stimulus presentation and the position of the response choices was varied. Only one selection from each set of response choices was permitted. Correct responses were recorded on a score sheet.

Reading Task. Each subject was presented with the reading task immediately following the training task. Two loose-leaf books, 5½ x 8½ inches, were used in the reading task. The pages were again covered with acetate. One book was used for the 10 groups learning to read similar words (Groups 1, 2, 5, 6, 9, 10, 13, 14, 17, and 18) and the other book was used for the 10 groups learning to read dissimilar words (Groups 3, 4, 7, 8, 11, 12, 15, 16, 19, and 20). A familiarization trial was provided for each subject prior to the main presentation of the reading task words: find, food, feed, foot for the similar words and fork, gate, drum, nest for the dissimilar words.

In familiarization, the subject was asked to look carefully at the word. While pointing to the word, the experimenter said, "The word is _____. What is the word?" This procedure was used for each of the 4 words the subject was to meet on the reading task.

Subjects were told that more words would be presented. "If you read a word correctly, I will tell you and you may put a colored peg in the peg board. Look carefully at the word and try to read it before I do." A page was turned over in the book exposing the stimulus word. During the anticipation interval of about 4 seconds the subject was expected to read a word. If the subject gave a correct response the experimenter confirmed it and repeated the word. If an incorrect response was given the experimenter said, "No, that word is _____." If no response was give the subject was told the correct word.

A learning trial consisted of 4 presentations, 1 for each word, in varying order. All subjects continued in the reading task to a criterion of 16 correct responses in 4 complete trials, or for a maximum of 12 trials, or 48 presentations. Correct responses, errors, and omissions were recorded on score sheets.

Recall Task. The same books used for the reading task were again used with the same subjects 24 hours later in the recall task. The first 3 of the 12 trials used in the reading task were presented. However, in recording the correct responses, errors, and omissions for the delayed recall task, only trials 2 and 3 were reported. Trial 1 was considered a "warm-up" trial. The responses were treated in the same way as for the reading task, but no peg board was used.

Subjects

The subjects were 160 children from 8 community kindergartens in Calgary, Canada. Eight subjects were assigned in rotating order to each of the 20 groups. Certain subjects (not included in the 160) were omitted from the study for the following reasons: 32 did not reach learning criterion in training familiarization, 1 was a reader, 1 could not speak, 1 was very emotionally disturbed, and 20 were not present on both days in the kindergarten. For all groups, ages ranged from 60 months to 77 months. The mean age was 67.9 months. There were no significant age

differences among groups. Each subject completed the training and reading tasks in about 20 minutes on one day and the recall task required about 3 minutes on the following day.

Results

In analyzing the data by trials, the 8 training trials were divided into 4 blocks of 2 trials each. The 2 trials of the recall task were combined into a single score. The 5 per cent level was selected for testing significance.

Training Task. Table 2 presents the mean number of correct responses and standard deviations in training for all groups combined over trials.

TABLE 2

MEANS AND STANDARD DEVIATIONS OF CORRECT RESPONSES ON TRAINING TASK COMBINED OVER TRIALS

Group		Mean	s.d.
1	SW - S - F	4.03	5.67
2	SW - S - M	3.25	6.08
3	SW - D - F	5.62	3.46
4	SW - D - M	5.09	6.42
5	SL - S - F	6.94	1.79
6	SL - S - M	6.41	2.29
7	SL - D - F	6.87	3.04
8	SL - D - M	6.69	3.49
9	DMW - S - F	3.09	4.44
10	DMW - S - M	3.50	4.64
11	DMW - D - F	5.12	7.92
12	DMW - D - M	3.84	5.85
13	SL + DMW - S - F	5.44	3.53
14	SL + DMW - S - M	4.81	3.38
15	SL + DMW - D - F	5.34	2.45
16	SL + DMW - D - M	5.44	1.56
17	DMW + SL - S - F	5.31	2.86
18	DMW + SL - S - M	5.31	4.66
19	DMW + SL - D - F	6.47	2.62
20	DMW + SL - D - M	5.50	4.33

Note—The key to training group designations is as follows: SW = Same Word; SL = Same Letter; DMW = Different Meaningful Word; S = Similar Words; D = Dissimilar Words; F = Female; M = Male.

The analysis of these data revealed a significant difference in the number of correct responses according to the kind of visual discrimination training. In addition, dissimilar words were significantly easier to match than similar words and females performed significantly better than males. There was a significant interaction between kind of discrimination training and kind of word. Table 3 shows the t-test values obtained from comparing all pairs of means for the kind of training with similar and dissimilar words.

TABLE 3

t-TEST VALUES COMPARING MEANS OF CORRECT RESPONSES FOR EACH KIND OF TRAINING WITH SIMILAR AND DISSIMILAR WORDS

Kind of Training	DMW	SW	SL + DMW	DMW + SL
	Similar Words			
SL	4.27*	3.83*	1.96*	1.72
DMW + SL	2.54*	2.11*	.24	
SL + DMW	2.30*	1.87		
SW	.43			
	Dissimilar Words			
SL	8.51*	5.25*	5.15*	2.96*
DMW + SL	5.55*	2.30*	2.19*	
SL +DMW	3.37*	.11		
SW	3.26*			

Note—Key to kind of training is as follows: SL = Same Letter; SW = Same Word; DMW = Different Meaningful Word.

* $p < .05$

The order of difficulty of learning for the kind of training was the same for similar and dissimilar words. Groups matching letters had the easiest task, while groups matching different-meaningful-words had the most difficult task. The interaction was due to smaller differences among groups matching similar words as compared to those matching dissimilar words.

Reading Task. The means and standard deviations for the correct responses, errors, and omissions in the reading task for all groups combined over trials are presented in Table 4.

The analysis of the data for the number of correct responses revealed that the only significant differences were in the kind of word, trials, and an interaction between trials and kind of word. Dissimilar words were significantly easier and faster to learn to read than similar words.

In the analysis of the number of incorrect responses, trials were significant in the expected direction and a complex interaction was found among kind of training, kind of word, and sex.

The analysis of omissions on the reading task indicated that trials were significant in the expected direction. The similarity of the words also made a significant difference. More subjects omitted responses to similar words than to dissimilar words.

Recall Task. Table 5 presents the mean number of correct responses and standard deviations in the recall task for all groups.

TABLE 4
MEANS AND STANDARD DEVIATIONS ON READING TASK
COMBINED OVER TRIALS

Group		Correct Responses		Errors		Omissions	
		Mean	s.d.	Mean	s.d.	Mean	s.d.
1	SW - S - F	1.87	6.51	3.31	9.94	2.81	15.05
2	SW - S - M	1.65	6.05	3.96	8.27	2.40	8.93
3	SW - D - F	3.23	6.91	3.40	5.27	1.37	4.41
4	SW - D - M	3.33	7.62	2.56	5.45	1.98	8.85
5	SL - S - F	1.69	6.27	3.90	8.06	2.31	11.34
6	SL - S - M	1.65	6.58	4.10	10.59	2.25	12.89
7	SL - D - F	3.54	6.63	3.08	6.12	1.37	8.93
8	SL - D - M	3.15	7.10	3.79	6.12	1.06	3.97
9	DMW - S - F	2.69	5.49	4.10	7.18	1.21	6.61
10	DMW - S - M	2.29	9.27	3.25	9.33	2.46	15.18
11	DMW - D - F	3.42	10.77	2.87	6.74	1.71	5.02
12	DMW - D - M	2.67	4.66	4.21	3.07	1.08	5.22
13	SL + DMW - S - F	2.10	8.12	3.65	7.66	2.25	9.87
14	SL + DMW - S - M	1.90	6.20	4.06	5.15	2.04	9.11
15	SL + DMW - D - F	3.10	11.20	3.62	9.67	1.27	5.59
16	SL + DMW - D - M	2.65	5.49	4.40	7.02	0.96	4.24
17	DMW + SL - S - F	1.62	4.24	4.25	6.02	2.06	7.23
18	DMW + SL - S - M	2.52	8.40	3.46	8.90	2.02	14.54
19	DMW + SL - D - F	3.85	8.62	2.98	3.79	1.17	6.89
20	DMW + SL - D - M	3.12	8.03	4.23	8.69	0.65	1.27

Note—The key to training group designations is as follows: SW = Same Word; SL = Same Letter; DMW = Different Meaningful Word; S = Similar Words; D = Dissimilar Words; F = Female; M = Male.

The analysis of the correct responses in the recall task showed that dissimilar words were significantly easier to read on a delayed recognition task than similar words. There was also a significant interaction between kind of word and sex. Comparisons using t-tests showed that on dissimilar words, females performed significantly better than males. There was no sex difference on similar words. This finding was reflected in the error analysis on the earlier reading task.

The analyses for both the errors and omissions on the recall task showed that, in each case, the only significant difference was in the kind of word. Similar words elicited more errors and omissions than dissimilar words.

By inspection, it is obvious that the mean number of correct responses on the recall task was greater than for the reading task (Tables 4 and 5) in all 20 groups. An examination of the data for the last trial only on the reading task indicated that for 17 out of the 20 groups, the mean number of correct responses was still greater on the delayed recognition task. This phenomenon appears to be a classic instance illustrating reminiscence effect (McGeoch and Irion, p. 11) resulting from

TABLE 5
MEANS AND STANDARD DEVIATIONS ON RECALL TASK

Group		Correct Responses		Errors		Omissions	
		Mean	s.d.	Mean	s.d.	Mean	s.d.
1	SW - S - F	2.50	2.00	2.75	1.56	2.75	2.68
2	SW - S - M	2.75	2.11	4.50	1.73	0.75	1.30
3	SW - D - F	4.50	2.06	2.62	1.41	0.88	1.05
4	SW - D - M	4.87	1.69	1.87	1.83	1.25	1.92
5	SL - S - F	2.75	1.20	3.12	1.83	2.12	2.37
6	SL - S - M	2.87	1.54	4.12	1.83	1.00	1.12
7	SL - D - F	6.00	1.22	1.25	1.20	0.75	0.83
8	SL - D - M	3.62	2.06	2.75	2.17	1.62	2.64
9	DMW - S - F	3.25	1.92	3.50	1.66	1.25	1.79
10	DMW - S - M	3.87	2.26	1.50	1.22	2.62	2.96
11	DMW - D - F	5.50	1.73	1.37	1.73	1.12	1.36
12	DMW - D - M	4.00	2.18	3.12	1.83	0.88	1.69
13	SL + DMW - S - F	3.25	1.39	2.62	1.65	2.12	1.69
14	SL + DMW - S - M	3.37	2.12	3.62	1.73	1.00	1.50
15	SL + DMW - D - F	5.00	2.29	2.62	1.87	0.38	0.70
16	SL + DMW - D - M	3.75	1.30	3.75	0.83	0.50	0.87
17	DMW + SL - S - F	3.50	1.00	3.87	1.45	0.63	0.99
18	DMW + SL - S - M	3.62	2.39	2.75	1.85	1.62	2.55
19	DMW + SL - D - F	5.12	1.69	2.37	1.32	0.50	0.71
20	DMW + SL - D - M	4.75	1.64	2.87	1.69	0.50	1.00

Note—The key to training group designations is as follows: SW = Same Word; SL = Same Letter; DMW = Different Meaningful Word; S = Similar Words; D = Dissimilar Words; F = Female; M = Male.

massed practice. The kindergarten children in this study were subjected to an intensive learning situation involving 23 trials or 92 presentations during the training and reading tasks in about a 20 minute session. The reading task, in particular, proved a difficult task judging by the per cent of correct responses. An accumulation of fatigue and decline of motivation undoubtedly interfered with attention and response factors, especially toward the end of the reading task. The 24 hour respite after completion of the reading task and administration of the recall task allowed these interfering factors to dissipate with a corresponding increase in task attention and response availability.

Discussion

Previous studies showed that visual discrimination training with individual letters and training children to respond to printed words as meaningful units were equally effective in preparing children for a reading task. The first question of the present study was whether combining forms of these two kinds of training would make for even greater facilitation, compared to either kind of training used exclusively. Based on the findings of this study, there was no statistical evidence that these combined training methods produced better results than the methods used

singly. However, in an examination of the correct response data for the reading and recall tasks in Tables 4 and 5 there is a suggestion that for similar words, training with meaningful words either by itself or combined with letter discrimination training produced better results in learning to read than either letter or word discrimination training.

Similarity in auditory and visual forms of a group of new words proved to be of great importance in determining the ease with which children learn to read words. Dissimilar words were consistently easier than similar words in the discrimination of the visual forms of words and letters, in learning to read, and in recognizing the words later.

The methods of visual discrimination training which facilitated learning to read words were equally effective on the delayed reading task.

Although girls showed a superiority over boys in visual discrimination training, this superiority was not transferred to the reading and recall tasks. Overall, sex differences were a function of the difficulty of the task.

Serious consideration should be given to the implications of the findings of this study for the use of beginning reading materials which control the sounds and frequently the resulting visual form of the words. If similar words are more difficult to discriminate than dissimilar words, should not the period of discrimination training be extended? If groups of similar words are more difficult to learn to read, what modifications are needed in introducing and reviewing new words? In theory, some linguistic approaches claim that introducing reading with words consistent in spelling and sound patterns facilitates mastery of the most consistent and frequent sound-spelling relations and generates the idea in beginning readers that there is a grapheme-phoneme relation basis to learning to decode the written language. The findings of the present study combine with common sense to show that groups of highly similar words, such as the linguists must use in order to control sound-spelling consistency (bin, pin, fin, tin), are difficult to discriminate among and, therefore, are difficult to learn to read relative to words that are dissimilar in spelling-sound profiles. Some research needs to be done to assess the net effect of these two variables operating in the same situation. Does the hypothesized reading facilitation due to phoneme-grapheme consistency override the confusing effect introduced by using groups of highly similar words in visual and auditory discrimination training? What teaching strategies should be considered to reduce the negative effects of word similarity in certain linguistic approaches, regardless of its negative influence?

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Using Words and Pictures in Foreign Language Learning

An experimental investigation was made to compare the effectiveness of using written words and pictures as cues for children's acquisition of vocabulary in a foreign language (Spanish). Eighty-two children in Grade 4, 5 and 6 learned ten Spanish words in a paired-associate learning situation. The stimulus items were five native-language concrete nouns and five pictorial representations of objects. Oral responses were required, in the form of the Spanish word equivalents. Learning occurred in significantly fewer trials with the pictures than with the words. The effects of age and sex were not significant. In a long-term retention test given one week later, performance paralleled that of the original learning session, with the majority of the children recalling more of the responses learned to the picture items than to the words.

Research into the learning of foreign languages has most often taken the form of comparisons of acquisition under different methods of teaching (Howe, Gordon & Willman, 1969). There have been numerous comparisons between modern audio-lingual approaches, which emphasize the primacy of speech, and cognitive code-learning approaches, in which greater importance is attached to grammar and translation. The results typically show no overall superiority for one type of method over the other (e.g., Chastein and Woerdehoff, 1968), but students who have learned by audio-lingual methods sometimes score higher in speaking ability than students who have been taught by cognitive methods, whereas students taught by modern cognitive code-learning methods sometimes have better grammar and writing skills than audio-lingual students (Scherer and Wertheimer, 1964). The statement by Crothers and Suppes (1967, p. 4) that "no existing psychological or linguistic theory can account for any substantial portion of the systematic details of language learning" remains valid, and there is little unambiguous evidence that would clearly indicate benefits of any particular approach or technique.

Interpretation of the findings of investigations that provide broad

comparisons between methods is hindered by the difficulty of ascertaining which combination of the typically large number of differences produced an observed difference in learning performance. This difficulty is avoided in simpler experiments that examine the separate sub-skills required in learning a foreign language. The present study concerns vocabulary acquisition. Although learning vocabulary items is but one of the various sub-skills required in foreign language learning, it is undoubtedly important, and it would be very useful to know what are the optimal learning conditions for acquiring the foreign language referents for specific words.

Kopstein & Roshal (1954) and Wimer & Lambert (1959) used paired-associate tasks to examine learning under conditions in which written words or pictorial representations of them formed the stimulus items. Responses took the form of the written foreign language referents. Learning was generally more successful when the stimulus items were pictures than when word-word pairs were used. This finding is consistent with Paivio's (1969) evidence that in a variety of simple learning tasks performance can be facilitated by conditions that encourage non-verbal mediation, requiring some kind of visual imagery. The use of pictorial stimulus items would seem to favor the occurrence of non-verbal mediation. Bugelski (1970), who provides further evidence for the greater effectiveness of strategies whereby learners are encouraged to use imagery in the learning of word lists, rather than verbalizing, points out that subjects who are instructed to verbalize frequently report the use of imagery even when they are not instructed to form images.

Foreign language instruction generally aims to provide the learner with the ability to speak as well as write in the chosen language. Therefore it would be useful to determine the relative effectiveness of pictorial and word stimulus items when the foreign language referent has to be provided in the form of an oral response. A study by Deno (1968) examined paired-associate learning of foreign language word items with verbal and pictorial representation of stimulus items in lists made up of similar or dissimilar concrete word items. The adult learners in his experiment had to pronounce the Japanese word responses in each pair. It was found that pictorial representation of items led to learning in fewer trials than verbal representation in the case of lists made up of similar words, but there was no difference in learning between the verbal and pictorial conditions when the stimulus words in the lists were dissimilar in meaning.

The present study investigated foreign language acquisition in school-age children. Learning under conditions using picture and written word items was compared in a task whereby learners were required to say aloud the Spanish language equivalents. The experimental subjects were school children in Grades 4, 5 and 6, and in addition to the learning task there was a comparison of their long-term retention under the different procedures.

Method

Subjects

A total of 82 English-speaking children, attending a private school

in a suburb of Boston, Massachusetts, served as subjects. No child had any knowledge of Spanish, but all took lessons in French. There were 26 children in Grade 4, 28 in Grade 5 and 28 in Grade 6, and their mean ages were respectively 9.3 years, 10.2 years and 11.3 years. I.Q. means and *SD*s were approximately equivalent for the 3 grades.

Materials

Each child learned ten Spanish words, five paired with a picture and five paired with the English word equivalent. Spanish was chosen because it was unfamiliar to the learners, and the words used were ones that are relatively easy for an English-speaking person to pronounce. Each item was a duosyllabic concrete noun without English or French cognates, having an English-language equivalent among the 100 most frequently used English words (Thorndike and Lorge, 1944). To balance the experimental design two stimulus items, one written and one pictorial, were made for each Spanish word. Each word or picture item was colored and appeared on an 8" by 11" card. To test the identifiability of pictures, eight 8-year old children were asked to say the one word that they thought each picture represented. Only pictures correctly identified by all eight children were used in the experiment. The Spanish words were presented by tape-recorder. For half the subjects the first five items were presented with the appropriate pictorial cue, and the remaining five items were paired with the corresponding written cue. For the other children this order was reversed. Within each group of five words the order of items was randomized across trials. In addition, the Spanish words that were paired with visual cues for half the children were paired with written words for the others.

Procedure

Each child participated individually. A complete trial consisted of one 5-second exposure of each of the ten cues. On the first five trials the subject heard a recorded Spanish word and simultaneously saw the appropriate picture or English word cue. Two seconds later the child heard the Spanish word again, and repeated it aloud. Two seconds after the 5-second presentation the next item would occur. The subsequent trials (Trial 6 and on) were of the same duration and item order, with word order within form (word or picture) randomized between trials, and required independent oral reproduction by the child of each Spanish word. The child saw a picture item or English word and had three seconds in which to attempt oral recall of the appropriate Spanish word. He then heard the correct Spanish word and repeated it aloud. This sequence continued for each trial until the subject achieved one perfect trial. A long-term retention test was given one week after the original learning session. On this occasion each child was shown the cue with which he had learned each Spanish word and was allowed five seconds in which to attempt oral recall.

Learning Criterion and Scoring

The words produced by the subjects on learning and long-term recall trials were scored on the basis of whether predetermined phonetic features indicating adequate reproduction were present or not. Perfect

pronunciation was not required. In the learning session the criterion used was the number of trials required to reach four out of five words correct with each of the two stimulus forms (words and pictures). This criterion was chosen as it appeared to be a stable and sensitive learning index.

Results

Learning was significantly more rapid with the pictorial than with the written stimuli, the mean number of trials to reach criterion being 9.93 with the pictures and 12.43 with the words. Of the 82 subjects, 55 first reached criterion performance with the pairs in which pictures formed the stimulus items, 25 first reached criterion with the word items,

TABLE 1
MEAN NUMBER OF TRIALS TO CRITERION AND SIGNIFICANCE OF DIFFERENCES BETWEEN PICTORIAL AND WORD STIMULUS ITEMS

Subjects	Pictorial Stimulus Item		Word Stimulus Item		p[1]
	Mean	SD	Mean	SD	
Age of class (grade)					
Nine years	10.05	5.07	11.80	6.92	.05
Ten years	10.75	4.32	14.95	6.68	.001
Eleven years	9.00	6.60	10.55	5.74	.05
Sex					
Boys	9.36	3.86	13.16	6.91	.001
Girls	10.50	2.91	11.70	6.36	.05
Sex within Age (by grade)					
Boys age nine	9.20	4.21	12.50	8.63	.001
Girls age nine	10.90	5.85	11.10	5.06	*n.s.*
Boys age ten	11.30	4.25	15.80	6.71	.001
Girls age ten	10.20	4.50	14.10	6.90	.001
Boys age eleven	7.60	7.64	11.20	4.61	.001
Girls age eleven	10.40	5.31	9.90	6.85	*n.s.*

[1] Significance of difference using Duncan's Multiple Range Test.

and 2 children reached the learning criterion with both cue forms on the same trial. Randomly selected female subjects were discarded to leave 10 boys and 10 girls in each of the 3 ages (grades) and the data were analysed using a three way analysis of variance, with repeated measures on the stimulus item form variable (i.e., word or pictures). The difference between picture and word items in mean trials to reach the learning criterion by all children was significant (for form of items $F = 29.43$, $df = 1/54$, $p < .001$), and there were significant differences in learning according to whether pictures or words formed the stimulus items for most of the grade and sex subgroups (see Table I). Neither of the other independent variables significantly affected the number of trials to reach criterion (for Age, $F = 1.97$, $df = 2/54$; for Sex, $F = 1.00$,

df = 1/54). However, there were significant interactions between form of stimulus item and each of the other variables (for Item Form X Age, F = 13.95, df = 2/54, $p < .001$; Item Form X Sex, F = 29.66, df = 1/54, $p < .001$; Item Form X Age X Sex, F = 5.88, df = 2/54, $p < .01$). No consistent simple trends were apparent, but as Table 1 shows there was a greater difference between words and pictures in trials to reach criterion among the 10-year old children than among the children of 9 and 11 years, and within each age the difference between word and picture forms was greater for boys than for girls. The results were further analysed using a two way analysis for all 92 subjects, with form of stimulus item and age as the only independent variables. Again, the F for stimulus item form was significant, but that for age level was not.

In the long-term retention test mean recall was greater for items learned with the picture cues than for items learned with words (4.03 items out of 5, versus 3.47 items out of 5) but the difference was not significant at the .05 level. Of the 55 subjects who reached criterion in the learning session with the picture cue first, 35 recalled more pictorially-cued than word-cued items in the retention test, 15 recalled an equal number of words with each type of item, and five recalled more items with the word stimulus. Even among the 25 children who in the original learning session reached learning criterion first with the pairs in which words formed the stimulus items, only nine recalled more items paired with word stimuli than with picture stimuli in the test of long-term retention.

Discussion

The consistently superior learning performance with pictorial than with written stimulus items suggests that the form of the native language item is an important variable in foreign-language concrete vocabulary learning. This result shows that children in ages between nine and eleven years do not conform to Deno's finding that using words of pictures makes little difference to adult learning of dissimilar vocabulary items. Precisely why children should differ from adults in this way is not clear, and research evidence is sparse (see Goulet, 1968), but it is likely that greater dependence upon verbal mediation in adults than in children may be a contributing factor (Davis, 1966). Note that the present finding applies only to the acquisition of oral skills. Other factors are clearly important when competence in the written language is required.

As Deno (1968) observes, a problem with the use of pictures for learning the referents of foreign words is that the meaning evoked by a picture may not be the same as that intended. The fact that pictures have been found to interfere with children's learning to read in their native language (Samuels, 1970) may be partly attributable to this. It is also conceivable that learning may be restricted to the particular images used in the task. However, in the case of children the former danger is not entirely absent when words are used, and there may be compensating advantages for picture items in the possibility that pictorial cues might help the learner gain independence from native language mediation processes.

In conclusion, pictures can be more effective than words for children who are learning to acquire oral competence in the vocabulary of a novel language (Spanish). The implications for the teacher are clear.

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Self-Ideal Congruence in Five Occupational Groups

A review of the research literature indicated that self and ideal-self (S-I) congruence variables have been related to measures of self acceptance, adjustment, flexibility, and performance. Normative data on the interpersonal checklist (ICL) was obtained from 584 subjects in five functionally different occupational groups: counsellors and teachers-in-training, priests, high school students, and army officer cadets. Significant differences in congruence between "self" and "ideal-self" were found upon group comparison. Implications for S-I congruence, personality, and vocational research are discussed. Normative data for ICL Self and Ideal-Self Concepts are available from the authors.

The self concept (S), which consists of the perceptions an individual has of himself, and the ideal-self concept (I), which contains personal aspirations, have been viewed as important referents of human behavior (Combs and Snygg, 1961; Lecky, 1945; Horney, 1942; Rogers, 1959; Wylie, 1961). The degree to which perceptions of self and ideal-self are in agreement with one another (as reflected by an S-I discrepancy or correlation) has been traditionally referred to as self-ideal (S-I) congruence (or discrepancy).

The meaning and importance of S-I congruence as a personality variable have been a subject for popular debate for almost two decades. In simplest terms high S-I congruence has been equated with self acceptance. In addition, a number of studies have suggested that a linear relationship exists between S-I congruence and adjustment. Rogers (1951) and Butler and Haigh (1954) found that S-I congruence increased during psychotherapy and such changes were accompanied by improved adjustment. Turner and Vanderlippe (1958) found that college students with high S-I congruence participated more in extra curricular activities, attained higher scholastic averages, received higher sociometric ratings and

appeared better adjusted on the Guilford-Zimmerman Temperament Survey, than students with low S-I congruence. Further support for a linear relationship between S-I congruence and adjustment has been reported by Chase (1957), Chordorkoff (1954), Crandall and Bellugi (1953), Eastman (1958), Friedman (1957) and Smith (1958).

In contrast, Block and Thomas (1955) have expressed reservations about viewing a person whose self concept and ideal-self concept closely match as being well-adjusted. They have presented findings which suggest that individuals with high S-I congruence have rigid and overly integrated personality structures. Furthermore, they have suggested that the relationship between S-I congruence and adjustment is curvilinear (inverted U). Cole *et. al.* (1967) and Zuckerman and Monashkin (1957) have also found that moderate S-I congruence is more indicative of adjustment.

Since adjustment and performance may be logically linked, S-I congruence has been investigated as a variable for predicting performance in various settings. As was the case with S-I congruence and adjustment, a certain amount of disagreement exists in drawing inferences about performance from the magnitude of a given S-I discrepancy. For instance, Waterland (1965) found no significant relationship between S-I congruence and counsellor performance. Vellutino (1964) concluded that the relationship between S-I congruence and the ability to make a "good" decision is curvilinear. Hay (1966) observed that engineering managers with high S-I congruence were more effective than managers with low S-I congruence. Park and Eberlein (1969) found that counsellor trainees with moderate S-I congruence were more flexible than counsellor trainees with either high or low S-I congruence. As well, Eberlein and Park (1971) have reported a significant curvilinear relationship (inverted U) between S-I congruence and performance of counsellor trainees as rated by their supervisors. Contradicting Turner and Vanderlippe's (1958) findings, Matheson (1969) found that high school students with low S-I congruence were higher achievers than students with high S-I congruence.

Problem

It seems apparent that despite some lack of agreement about meaning, the concept of S-I congruence has proven to be a fruitful personality variable and thus merits further systematic investigation. It is also apparent, however, that most of the studies which have concentrated on concepts of self have utilized different instruments and different equations for generating scores which reflect congruence. The result of these divergent approaches to the study of S-I congruence has created a situation wherein the individual researcher is left puzzled about how representative are the congruences in his particular sample. There also appears to be a dearth of information about what facts, if any, are concealed by global S-I congruence scores which have been calculated from a large number of personality traits. That is to say, it is quite possible that two individuals (or groups) can have equal S-I congruence scores while having different scores on the dimensions which comprise self and ideal-self concepts. The present study was undertaken to obtain normative S-I congruence data for the Interpersonal Check List (ICL) and to examine

differences in self concept, ideal-self concept, and S-I congruence which might exist between a variety of groups with different functional roles.

Method

Sample

The sample in the present study consisted of the following five groups:

(1) Group one consisted of 121 counsellor trainees who were registered in The University of Alberta Educational Psychology counselling practicum between 1967 and 1969. Most of the trainees were in the first year of the Masters Degree program in Educational Psychology or in a related graduate diploma program. This group included 36 females and 85 male trainees.

(2) Group two consisted of 307 teachers-in-training who were registered in a senior undergraduate University of Alberta Educational Psychology course concerned with classroom social dynamics. This group was mainly composed of students whose teaching experience was limited to one practicum course; a significant minority, however, were teachers who were returning to university to upgrade their qualifications. The teacher group contained 185 females and 122 males. ICL data was collected from four sections of the course offered in 1968 and 1969.

(3) Group three consisted of 25 Alberta priests who were registered in a three day pastoral counselling seminar in May, 1968.

(4) Group four consisted of 67 Grade X students from Summerside, Prince Edward Island, in May, 1968. The students were volunteers and represented 67 per cent of the grade X population. This part of the sample included 41 females and 26 males.

(5) Group five consisted of 64 male Canadian Army Officer cadets who were attending a leadership training program in Manitoba in the summer of 1969. The cadets were students registered in degree programs at various Canadian universities. (Bain, 1970)

Self Concept and Ideal-Self Concept Scores

The Interpersonal Check List (ICL) (Leary, 1957) was used to obtain measures of self concept and ideal-self concept. Each group of trainees was first given a "set" to respond to each of the 134 ICL adjectives or phrases for the purpose of reporting self concept: "This is how I see myself." They were then requested to re-do the instrument using a second "set" to measure their ideal-self concept: "This is the way I would like to be." As each ICL item has been assigned an intensity weight, S and I scores were obtained on 16 dimensions by summing intensities for items checked "true" for each trainee. ICL octant scores were obtained by combining adjacent 16's in accordance with Leary's theory (1957). Further scores on four dimensions were obtained from a factor analysis of responses made by all subjects in this study (Eberlein, 1969). To determine S-I congruence a vector analysis technique measured the distance between the 16, 8, and 4 S dimensions and the similar I dimensions.[1]

Since the priests and army cadets included only male *S*s there was a question as to whether or not their S-I discrepancy scores would be

[1] The distances between two vectors with n-components in n-dimensional Euclidean space can be determined by vector analysis techniques. In the present study S-I discrepancies were calculated with the following formula:

$$|S\text{-}I| = [\sum_{i=1} (S_i - I_i)^2]^{1/2}$$

S and I are vectors of self and ideal-self concept scores respectively. High S-I discrepancies are associated with low S-I congruence and low S-I discrepancies are associated with high S-I congruences.

comparable to S-I discrepancy scores obtained from the other groups containing both male and female *Ss*; *t*-tests were therefore used to determine whether or not significant differences existed between the discrepancy scores of males and females within each of the other three groups. As only small and non-significant differences were observed, *Ss*' scores were not separated according to sex for further analyses on the congruence data.

In order to determine whether or not the overall differences between groups were significant a one way analysis of variance procedure was utilized to compare means. Table 1 reports both the significant F ratio obtained and the results of a Scheffe analysis, along with mean S-I discrepancies of each of the five groups.

TABLE 1
SELF-IDEAL DISCREPANCY SCORES FOR FIVE SAMPLE GROUPS[1]

Group	N	Mean	SD
Counsellors in training	121	16.80	7.09
Teachers in training	307	19.07	6.52
Priests	25	22.17	7.00
High School Students	67	19.94	5.45
Army Officer Cadets	64	16.60	6.04
Total all groups	584	18.56	6.62

[1]Analysis of Variance yielded $F = 6.84$, $p < .001$; Scheffe comparison yielded significance at .05 level on following: (1) counsellors compared with teachers, priests, and high school students, (2) priests compared with army officer cadets.

Results and Discussion

The magnitude of the S-I discrepancy is inversely related to congruence. From Table 1, one finds the priest group obtained the highest mean S-I discrepancy scores and therefore they were *least* congruent. On the other hand, counsellor trainees and army officer cadets were the *most* congruent, both differing significantly from the priests. In addition, the counsellor trainee group was significantly more congruent than teacher trainees and high school students.

While it has been traditional to interpret findings on the basis of "global" congruence scores, the authors felt that subtle differences between groups might be made clearer by examining group S-I discrepancies on individual dimensions. For each group the S-I discrepancy for each of the sixteen dimensions was calculated. These were ranked in terms of their contribution to the global S-I discrepancy score (Table 2),

RANK-ORDER OF SELF-IDEAL DISCREPANCY ON 16 ICL DIMENSIONS SCORES FOR FIVE SAMPLE GROUPS

	Counsellors in training		Teachers in training		Priests		High School Students		Cadets
A. Self Higher Than Ideal (from most to least discrepant)									
Rank	Dimension	Rank	Dimension	Rank	Dimension	Rank	Dimension	Rank	Dimension
1	Self-effacing	2	Self-effacing	2	Self-effacing	1	Distrustful	2	Distrustful
3	Distrustful	3	Distrustful	3	Distrustful	3	Self-effacing	3	Self-effacing
4	Rebellious	4	Rebellious	4	Rebellious	4	Rebellious	4	Rebellious
6	Dependent	5	Masochistic	6	Sadistic	7	Aggressive	5	Dependent
7	Masochistic	6	Dependent	7	Narcissistic	8	Masochistic	7	Masochistic
8	Aggressive	7	Docile	8	Aggressive	9	Dependent	9	Sadistic
9	Docile	8	Aggressive	9	Competitive	11	Sadistic	13	Docile
11	Sadistic	10	Sadistic	10	Masochistic	13	Docile	14	Aggressive
15	Competitive	14	Cooperative	11	Autocratic	16	Competitive		
		15	Competitive	12	Dependent				
				14	Cooperative				
				16	Managerial				
B. Ideal Higher Than Self (from most to least discrepant)									
Rank	Dimension	Rank	Dimension	Rank	Dimension	Rank	Dimension	Rank	Dimension
2	Over Conventional	1	Over Conventional	1	Over Conventional	2	Over Conventional	1	Over Conventional
5	Responsible	9	Responsible	5	Responsible	5	Autocratic	6	Managerial
10	Hyper-normal	11	Managerial	13	Hyper-normal	6	Managerial	8	Autocratic
12	Autocratic	12	Narcissistic	15	Docile	10	Responsible	10	Responsible
13	Managerial	13	Autocratic			12	Hyper-normal	11	Hyper-normal
14	Narcissistic	16	Hyper-normal			14	Narcissistic	12	Competitive
16	Cooperative					15	Cooperative	15	Cooperative
								16	Narcissistic

The trait for which the greatest S-I discrepancy was observed was given rank "1"; the trait which contributed least to global discrepancy received rank "16". Part A of the table reflects traits where self scores were higher than the ideal; Part B reflects ideal scores higher than the way the group saw themselves at present.

While the present paper is primarily concerned with S-I congruence as a personality variable, the collection of normative data on each of the ICL 16, 8 and 4 dimensions was of interest to the investigators and may be obtained by writing the senior author.

Two questions about these results seem pertinent for discussion:

1. Are these results supportive of previous research on S-I congruence theory?
2. Do these results have implications for the relationship between personality and vocational choice?

As was mentioned earlier, high S-I congruence has been traditionally treated as being synonymous with self-acceptance, while low S-I congruence has been linked with self-rejection and self-deprecation. Similarly, it has been generally accepted that low S-I congruence is associated with difficulties in adjustment, while the meaning of high S-I congruence is less clear. When applied to the groups in the present study and using the linear model, these findings suggest that the army officer cadets and counsellor trainees are more confident, less self-deprecating, and probably less in conflict about personal matters than the priests.

Independent support for the above interpretation is noted in the following remarks by Siegelman and Peck (1960) about army officers and ministers:

> The officer appears to have confidence in his ability to achieve his goals, and he looks for the most favourable environmental conditions to support his efforts. Perhaps inner security and stability permit and facilitate energy investment in external issues and an adequate personally acceptable job of coping with his problems. (p. 321)
>
> The minister is more "introverted" than the military officer.... Insecurity and anxiety about personal qualities are indicated and there is a searching desire to critically scrutinize his abilities. One possible reason for this emphasis on personal short-comings might be a need for attention, acceptance, and approval which he unconsciously attempts to elicit by his honest, self-derogatory remarks. (p. 219)

To a lesser extent similar inferences might be extended to describe the counsellor, teacher, and student groups with respect to where they fall on the S-I congruence continuum.

The student group represents a population which is less committed to a particular vocation. Previous research by Bloom (1961) has indicated that S-I congruence increases with age (until age 59, after which it begins to decrease). Since adolescents typically are viewed as experiencing anxiety over interpersonal, social and sexual problems it should not be surprising that the high school student group obtained the second highest mean S-I discrepancy scores.

The relatively low S-I discrepancies of the counsellor group could be a favourable sign. Byrne (1966) has suggested that individuals with low

S-I discrepancies favour avoidance-denial defensive modes, while individuals with high S-I discrepancies are more likely to display intellectualization and sensitization defensive styles. Bales (1970), in his recent discussion of personality types, has suggested that it is characteristic of individuals given to avoidance-denial defense sets to possess the power of being able to alleviate anxieties in others. To have such a talent would seem desirable in many counselling situations. On the other hand, an extreme usage of avoidance-denial defenses could lead to lack of flexibility in personality structure (Block and Thomas, 1955) which would handicap counselling process development. This raises the possibility that counsellor trainees may be, in general, overly integrated individuals who seek security in a rather non-threatening environment away from classroom frustrations or business pressures by working with less secure individuals than themselves. The authors suspect, however, that a larger sampling of vocational populations would uncover a variety of occupations which attract individuals with more rigid personalities and hence lower S-I discrepancies.

It is important to note the similar ranking of characteristics which contributed to the global S-I discrepancies of all groups. By examining Table 2 one can observe that all groups expressed a desire to be less self-effacing, less distrustful, and rebellious while being more conventional and responsible. Priests were slightly different from other groups in the sense that they had more of most traits than they deemed desirable. In particular, they expressed a need to be less narcissistic whereas all other groups felt that it would be ideal to have more of that trait. While the similarities noted may be an indication of the influence of a social-desirability factor, these results suggest the possibility that diverse groups of individuals are basically similar with regards to the traits about which they feel discrepant. This thesis could be examined by a closer analysis of trait discrepancies for a larger number of groups.

The differences observed in S-I congruence for the four vocational groups offer support to those writers who have suggested that there are conceptual similarities between vocational interest and personality (Seiss and Jackson, 1970) or who believe that vocational choice is the implementation of self concept and self-regard (Becker and Strauss, 1956; Thompson, 1960). It would be relevant to replicate the present study in a different cultural setting paying closer attention to pre and post - training concepts of self, age, socio-economic background and so forth. For example, it might be interesting to examine relationships between adjustment measures on some personality inventory, self-ideal congruence, and vocational choice. In this way some clarification about whether priests' high S-I discrepancies were related to their idiosyncratic concern with the imperfection of man. Similarly, such research might reveal whether there is truth in the assertion that vocational choices and interests are "part and parcel of the individual's total striving for adjustment and grow out of needs arising in his personality development" (Darley and Hagenah, 1955, p. 263).

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Success of Mature Age Students In University Studies

When "mature" students who do not have the regular admissions requirements to University are permitted to enroll, how will their perforance on a test of general educational achievement and their grade point average compare with regularly admitted students? The data presented in this report suggests that if "mature" students concentrate their studies in the Arts and Humanities they may be quite successful. While the "mature" students as a group had some of the poorest results when compared with four other groups of students on the College Qualification Test, they had some of the best results when compared on grade point average.

When the University of Lethbridge began its first academic year in September, 1967, it had no results or norms on standardized tests to indicate the level of performance of freshmen students who were being admitted to university. Students were admitted on the basis of their performance on an external senior matriculation examination written at the conclusion of high school. This was the custom in most provinces in Canada.

A matter of concern to university officials was the need to have more suitable criteria from which to admit "mature" students—a special admission category at the University of Lethbridge. A "mature" student for admission purposes was defined as a student 21 years of age or over, who lacked the regular senior matriculation requirements and in some instances, dropped out of school before reaching grade twelve. Because of the exigencies of the situation, (first year of operation of an "instant" university) twenty-three mature students were admitted in September, 1967, on the basis of an interview with the investigator, their previous school record, their work experience, and a recommendation from their employer, principals or teachers attesting to their ability to profit from university work.

It was anticipated that as the mature student plan became more

widely known, an ever increasing number of people would make application to be admitted under this policy. This was confirmed in the Fall of 1968 when approximately sixty "mature" students were admitted. (In 1969-70, there were approximately 200 "mature" students enrolled at the University of Lethbridge.) A more objective evaluation of students was needed in order to be able to make more predictive correlations with grade point averages and do a more effective job of screening applicants. Because of their lack of recent background in the natural and physical sciences, most of the "mature" students tended to concentrate on Arts courses.

Further, it was extremely desirable to compare the general academic performance level of the mature student upon admittance with that of the typical freshman who had just graduated from high school. It was considered even more important, however, to follow the "mature" students and compare their actual performance (GPA) with those of other freshmen.

Douglas (1931) and Travers (1949) had both written about the lack of relationship between the pattern of high school subjects and success in university, with the requirements for specific high school credits and courses barring as many superior as inferior students from university. Cook (1961, 1962) compared the college performance in two consecutive years at the University of Indiana of 1400 freshmen and 2,425 freshmen who had college preparatory and non-college preparatory work. He concluded: "It did not make a great deal of difference whether a student took a college preparatory course (with more mathematics, language and science) or a non-college preparatory course as far as grades earned in college were concerned".

It was the purpose of this study, then, to compare the performance of "mature" students who did not have the usual pattern of academic subjects for admittance to university with several groups of regularly admitted freshmen on the College Qualification Test (CQT) and on the Fall, Spring, and Accumulative grade point average (GPA).

Procedure

Since the freshmen who were entering university direct from high school had varying degrees of proficiency on an external senior matriculation examination, particularly as to the number of subjects written and passed, it was decided to categorize the students accordingly.

Consequently, as shown in each of the tables where all the groups are compared, the following groups were formed:

Group I was comprised of students who had five subjects on senior matriculation exams with an average of 60% or better but failed the sixth subject.

Group II was comprised of students who completed five subjects on the senior matriculation with an average of 60%+ but had passed the sixth (50% to 59%).

Group III was comprised of students who had six subjects with an average of 60%+ and wrote 6 to 8 exams to do so.

Group IV was comprised of students who had written five subjects with an average of 60%+ but had to write 9 or more examinations to do so. The average number of exams written by this group was 11, with one student writing 18 exams to obtain an average of 60%+ in five subjects. This group was thought of as the "persisters". The investigator was particularly concerned with how this group compared with the other groups.

Group V was comprised of "mature students" (non-matriculants) who were admitted on the basis mentioned earlier. It should be pointed out that the age range for this group was from 21 to 53 years of age. The mean age was 30 years.

Group VI was the total group—all five groups together.

Sample

The sample consisted of 107 first year students subdivided into the five groups mentioned. Originally, a random sample of 25 in each of the first four groups was obtained from the Registrar's Office which together with the 23 in the mature student group would have made a total of 123 students. Since participation in this project was purely voluntary, not all of the students wrote the CQT, with the result that the total N was 107 students, instead of the possible 123.

Test Used

The College Qualification Test was used in this study because of the flexibility it gave in being able to be administered at the University's convenience and not on the date specified by the publisher. This is particularly important in a sparsely populated area like southern Alberta. When a student travels a considerable distance to inquire about a mature student admission, it is possible for him to take the CQT during that visit and not have to make a second journey to write the test.

The College Qualification Test is published by the Psychological Corporation, New York; it was normed in 1956 on 22,000 freshmen college students. It is an objective multiple choice type test. The several sub-tests include: (1) *Verbal* which takes 15 minutes and consists primarily of antonyms and synonyms, (2) *N or Mathematics* which takes 35 minutes and includes general arithmetic and elementary algebra, and (3) *Information* which takes 30 minutes and can be sub-divided into science and social studies. The total test time, then, is 80 minutes and the total possible test score 200, sub-divided as follows: Verbal 75, Math 50, Information 75 with Social Studies being 37 and Science 38.

Administering the Test

The students participating in this study were asked to report to the University on a Saturday early in the Fall semester specifically to write the CQT. Approximately, two-thirds of the sample reported at the place and time requested. The students in the remaining one-third of the sample were contacted individually and tested at the Counselling Center individually or in small groups.

TALE 1
MEANS AND STANDARD DEVIATIONS FOR THE FIVE GROUPS AND TOTAL GROUP ON THE SUBTESTS AND TOTAL CQT, 1967-68

	N	V (Verbal)		N (Math)		I (Total)		I (Science)		I (Social Studies)		C.Q.T.	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Group I	20	51.20	11.57	38.75	7.25	51.30	7.26	27.85	4.50	23.45	3.94	141.25	17.37
Group II	22	52.45	10.30	40.95	4.90	55.09	7.02	29.77	4.08	25.32	4.19	148.50	19.37
Group III	22	57.36	10.21	45.50	3.71	57.86	6.34	31.59	3.16	26.27	4.22	160.73	16.80
Group IV	25	49.04	9.25	39.00	5.23	52.80	7.08	28.64	4.17	24.16	3.94	140.84	15.73
Group V	18	60.78	9.86	28.78	8.06	50.72	8.50	27.17	4.18	23.60	5.59	140.28	19.12
Group VI (Total)	107	53.83	10.89	38.97	7.80	53.68	7.54	29.08	4.24	24.60	4.41	146.49	19.00

Analysis of Data

To determine if there were any differences among the five groups, a one way analysis of variance was computed for each CQT sub-test, total test and grade point averages for each semester and the combined semesters. When an *F* test in a one way analysis of variance indicated a significant difference, a Duncan multiple range test was computed to determine which pairs of means were significantly different.

Results

Because of the detailed nature of analysis of variance tables, only summary tables are presented here (more complete tables may be obtained from the author).

For convenience and ease of comparison, Table 1 presents a summary of the CQT sub-tests and total test (aggregate of sub-tests) means and standard deviations for the five groups and total groups. The "mature" students had the lowest mean score of the five groups on all the sub-tests except the Verbal in which they received the highest mean. Also, they received the lowest mean of the five groups on the CQT total score.

The *F*-values reported in Table 2 were highly significant ($p < .01$) in the area of Verbal, Mathematics, Science and the Total Test. The groups which showed significant differences in these areas are shown in the last column of Table 1, with the first mentioned group of pairs having the smallest difference between means, but still having a significant difference. It is interesting to note that the "mature" students were significantly different from group four in the Verbal sub-test.

TABLE 2

ANALYSIS OF VARIANCE RESULTS FOR THE FIVE GROUPS ON THE CQT SUBTESTS AND TOTAL TEST

Area	df	Sums of Squares	Mean Square	*F*	Groups With Significant Differences[1]
Verbal	4	1897.15	474.29	4.54**	V & IV
Mathematics	4	2895.60	723.90	20.79**	III & IV, III & I, III & V, II & V, IV & I, IV & I, IV & V, I & V
Information	4	718.98	179.74	3.45*	III & IV, III & I, III & V
Science	4	250.25	62.56	3.85**	III & I, III & V
Social Studies	4	123.83	30.96	1.63ns	
Total Test	4	6590.13	1647.53	5.30**	III & I, III & IV, III & V

[1]The first group mentioned in each pair of groups has the largest mean score; the smallest mean difference is between pairs of groups mentioned first, e.g., last pair of groups mentioned has the largest mean differences.

*$p < .05$; **$p < .01$.

The *F*-value in the area of Information was significant ($p < .05$) with group three being significantly different from groups one, five, and four.

Group three, the group that passed six senior matriculation subjects—more than any other group—is, of course, the group with the consistently superior performance on the CQT as shown by the number of times it is cited in the last column of Table 1.

The area of Social Studies does not show any significant *F*-value between the groups.

In Table 3, the Fall, Spring and Accumulative GPA are summarized for the five groups and total group, with the "mature" students achieving the highest Fall GPA, the second highest Spring GPA and the highest Accumulative GPA.

TABLE 3

MEANS AND STANDARD DEVIATIONS OF THE FIVE GROUPS OF FRESHMEN AND TOTAL GROUP ON FALL, SPRING AND ACCUMULATIVE G.P.A.

	N	Fall GPA		Spring GPA		Accumulative GPA	
		Mean	SD	Mean	SD	Mean	SD
Group I	16	1.91	.58	1.89	.55	1.90	.50
Group II	16	2.15	.86	2.26	.75	2.18	.76
Group III	21	2.40	.71	2.38	.73	2.37	.63
Group IV	21	1.95	.67	2.03	.68	1.99	.67
Group V	14	2.54	.84	2.32	1.14	2.47	.89
Group VI (Total)	88	2.18	.75	2.18	.78	2.18	.71

The *F*-value presented in Table 4 for the five groups on the Accumulative GPA means was significant ($p < .05$). As the last column of the table shows, group five, the "mature" students, was significantly different from groups one and four, but not from groups two and three.

Discussion

This preliminary or pilot study done with regularly admitted and specially admitted "mature" students at the University of Lethbridge during its first year of operation, 1967-68, reveals some interesting results.

Analysis of variance summaries on all of the CQT sub-tests and total test showed that there were some significant differences among the groups on some of the sub-tests. There was also significant differences among some of the groups on CQT total test (an aggregate of all the sub-tests).

The data showed in Table 1 that when the "mature" students were compared on the CQT with the other four groups, regularly admitted freshmen obtained the lowest mean score on four of the five CQT sub-tests; the sub-test on which they attained the highest score was the Verbal. On the CQT total score, the "mature" students had the lowest mean score. Nevertheless, these same students had the highest Accumulative GPA of the five groups and were significantly different from groups one

TABLE 4
ANALYSIS OF VARIANCE RESULTS FOR THE FIVE GROUPS ON THE ACCUMULATIVE GPA MEANS 1967-68

Source	df	Sum of Squares	Mean Square		Groups With Significant Differences[1]
Between Groups	4	3.94	0.99	2.05*	V & IV, V & I
Within Groups	83	39.82	0.48		

[1]The first group mentioned in each pair of groups has the largest mean score; the smallest mean difference is between pairs of groups mentioned first, eg. last pair of groups mentioned has the largest mean differences.

*$p<.05$.

and four (Table 4). It would seem that the "mature" students' higher GPA was due to their superior maturity and motivation as well as their selection of non science subjects.

While the sample is too small to make broad generalizations, one cannot help speculating as to whether the CQT or for that matter, any other general achievement test can adequately predict the success of "mature" students with university work, positively, if they enroll in the Arts courses and do not select subjects in science, as nearly all the "mature" students in this study did. It would seem that maturity and motivation compensate for their lack of past formal educational experience, as far as the study of Arts and Humanities is concerned.

The success of "mature" students at the University of Lethbridge during 1967-68 would tend to support the views of Douglas (1931), Travers (1949) and Cook (1961, 1962). It seems that, given a minimum native ability or intelligence, the crucial factor for success at university is motivation and not necessarily prior experience in certain subjects, particularly in the Arts and Humanities courses. Because motivation seems to play such a vital role in the success of the "mature" students, a test of motivation was given to the students participating in another study conducted during 1968-69. It will be interesting to see if this more recent study which is currently being analyzed and which includes the Motivational Analysis Test contributes to our understanding of the success of "mature" students.

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Cognitive Perception and the Conceptual Foundations of Research In Educational History

This article examines some of the principles of psychological set and perception, and their application to the educational historian's understanding of history or historical reality. The traditional distinction between what actually happened in history and what is recorded or interpreted is examined in the light of these principles. The educational historian runs the risk of enacting the "self-fulfilling prophecy" in conducting his research if he operates according to the traditional distinction between "history as actuality" and "history as interpretation." The study suggests that the conceptual foundations of historical inquiry and their psychological implications require further research.

Leopold von Ranke, the father of scientific history, once remarked that the "supreme law" of historical inquiry is "the strict presentation of facts, contingent and unattractive though they may be (1956, p. 57)." In recent times, Ranke's dictum has prompted educational historians to direct their attention to the problem of objectivity (Bailyn, 1960; Butts, 1967), and has necessitated a re-examination of some of the traditional assumptions relating to historical evidence and interpretation. The question eventually comes round to the nature of history or historical reality and how an understanding of that reality is dependent upon the historian's psychological perception.

Set, Perception and Historical Reality

There is evidence to suggest that one's cognitive perception of any situation is, in part, shaped by what psychologists term set or *Einstellung* (Bruner and Postman, 1948; Forgus, 1966; Hollander, 1967; Stewin, 1969). Set, which might be regarded as a state of readiness, predisposes the subject to adopt a particular mental outlook (English and English, 1958). Such an outlook entails perception which, in turn, can generally be defined as "the process by which an organism receives or extracts information about the environment (Forgus, 1966, p. 2)." Taken together,

set and perception are integral to the historian's personality (Stewin, 1969) and, hence, affect his view of historical reality. Fritz Medicus writes:

> A given event may be treated by one historian as of the greatest importance, and by another as quite incidental for the knowledge of a certain group of facts: each of the two historians is facing it with the experience of his own personality... he cannot understand it except in relation to what gives concreteness to his life (1963, p. 141).

Compounded of his needs, values, hopes, past experience and culture, the historian's personality reflects "all those items of his past history which have gone into making him what he is (Bruner and Postman, 1948, p. 84)."

In its broadest sense, perception aims at the "construction of a stable and meaningful environment (Postman and Bruner, 1948, p. 322)," the attainment of which entails a process of categorization (Bruner and Postman, 1948; Bruner, Goodnow and Austin, 1956). This procedure serves to organize and direct the historian's interpretation of reality. Research indicates that already existing categories are usually employed to determine new experience, thereby tending to make the use of such categories inflexible and somewhat permanent (Youtz, 1948; Postman and Bruner, 1948). It is not unusual, therefore, to find that the educational historian readily assumes the standardized categories established by his profession. Charles Beard delimits history in terms of these categories when he writes:

> What, then, is this manifestation of omniscience called history? It is, as Croce says, contemporary thought about the past. History as actuality includes, to be sure, all that has been done, said, felt, and thought by human beings on this planet since humanity began its long career. History as record embraces the monuments, documents and symbols which provide such knowledge as we have or can find respecting past actuality (1934, p. 219).

Thus historical reality represents both a past *existence,* apart from any activity in which the historian may be engaged, and the subsequent *interpretation* of that existence.

A fundamental principle of perception states that individuals "tend to perceive experiences in the way in which they expect to perceive them (Hollander, 1967, p. 96)." Known as perceptual constancy, this phenomenon implies that the conceptual structure imposed upon an experience follows from preconceived notions as to how that experience ought to be interpreted. If this is the case, it would not be unexpected for the researcher to adopt *a priori* the twofold approach towards historical reality. Whether an event under study, therefore, centers on the social forces shaping the growth of the medieval university or the theoretical basis underlying Pierre Abelard's teaching method, the historian perceives this event in terms of what actually happened and what subsequently was recorded and interpreted.

Related to this psychological orientation are cognitive principles of wholeness and closure. Wholeness, the tendency to see stimuli as fitting together, and closure, the adding in of absent elements so as to achieve wholeness (Hollander, 1967, p. 96), predispose the individual

to consider history as actuality to be interdependent with and *complementary* to history as interpretation. In effect, these principles reinforce cognitive perception along lines of the dualistic framework. Educational historians generally assume a connection, for example, between Rousseau's recorded ideas on education and a pre-existing state of affairs or "stratum of reality" of which those ideas were originally a part. In this case, the historian, viewing the association between "actuality" and "interpretation" as "proximal or sequential" (Hollander, 1967, p. 99), may impute a type of causality to this association where none may exist. As Anthony Quinton concludes, "the relations that obtain within the body of our knowledge do not also connect it with what is outside (1967, p. 84)."

Implications

Although it might be argued that a dualistic approach to the understanding of educational history has proved workable in everyday research, it must be noted that the acceptance of such a conceptual foundation may harbour difficulties for which the historian is not fully prepared. In assuming that history is in part actuality, the historian knowingly or otherwise supposes an imaginary model or standard of perfection which functions as a criterion for the completeness of his inquiry. Such a model, however, can only be used if it can be made explicit. One cannot realistically pursue a model which is undefinable and appears to be beyond means of empirical verification. Again, how does one meaningfully describe or explain something which cannot be cognitively perceived?

These objections might be answered by suggesting that the past as actuality becomes what the historian presumes it was. If this is the case, however, the past as actuality cannot be differentiated from the past as interpretation and historical inquiry might become nothing other than an expectation, the supposed attainment of which could well lead to a classical instance of the "self-fulfilling prophecy." How, then, does one decide which interpretation of an educational event is the most acceptable? Further, what is the historian's alternative to his present conceptual foundation? In answering these questions, one should not be unaware of Napoleon's charge that "History is but a fable, agreed upon."

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Component Curve Analysis of Student Performance on a Computer-Based Simulation Game[1]

A review of the theoretical basis of component curve analysis, a multivariate technique for examining learning data from a repeated measures design, is given. Variations in the method and unresolved issues such as rotation are discussed. The method is illustrated using data from student performance records on a computer-based simulation game. The results illustrate the potential value of the method for describing such a complex learning situation.

The history of learning theory has largely been one of apparent contradiction. A large number of experiments have been performed under many different stimulus situations using many different samples in order to prove or disprove a particular theory that is currently in vogue or to make a choice between two prominent positions. In general it seems fair to conclude that under a certain set of conditions one theory has been shown to be the more desirable whereas under slightly different conditions (or often, even under 'identical' conditions) a different theory has become more tenable. The result has been a trend toward "micro-theory", each theory being valid only for a very restricted domain of circumstances. The herculean task facing current researchers is to consolidate this ever increasing and expanding wealth of related material.

A general feature of almost all educational research conducted prior to the last decade, and indeed, a large proportion of current research, has been the bivariate nature of the experiments. All physical variables are controlled by using a highly simplified situation and the tremendous complexity of individual differences is assumed controlled for by the process of randomization. The researcher is left with two variables and his task is to observe the relation between them. In more

[1] Thanks are due to Dr. S. Hunka, Coordinator, Division of Educational Research Services, for advice in the preparation of this manuscript.

complex studies there may be more than two variables but they are usually assumed to be independent of each other and separate analyses are conducted for each set of variables. Cattell (1966) summarizes this state of affairs as follows:

> ...a good deal of the fruitlessness of the immense labour spent in trying to arrive at firm and comprehensive laws of learning by bivariate research has been due to a great part of the relevant picture being blotted out from the experimenter's calculations (p. 479).

It is apparent that other approaches will be necessary in order to extricate ourselves from the virtually infinite number of hypotheses that can be validated by only looking at a small slice of the total picture. Fortunately the advent of computers has brought methods of analysis within the researcher's domain that have been impossible to carry out manually. For example, multivariate analyses—including factor analysis—are now possible whereas only a few years ago they would have had to be rejected because of the immense labour involved in doing the calculations.

Within the context of learning theories, it often happens that the average learning curve for a group of subjects does not represent the learning curve for any single individual. For example, in studies that examine "insight" in a problem solving task, each subject's learning curve will show a sharp increase at the point in time when he understands the problem. Yet because different subjects "see" the solution at different times, the average learning curve will show none of the sharp increases but rather a gradual rate of increase. This type of situation justifies looking at other approaches for examining learning data, such as that of component curve analysis.

It is the purpose of this paper to present a technique that is illustrative of a multivariate approach to learning theory. The applications of factor analytic methods to learning data was first investigated by Tucker in 1960. Initial results (Weitzman, 1959, 1963; Tucker, 1960; Duncanson, 1964) have been encouraging and it appears that the method may make a useful contribution to the development of learning theory.

The source of data used for this particular study consists of performance records of a group of students on a simulation game that was presented via an IBM 1500 instructional computer system. The primary purpose of this study was to examine the suitability of Tucker's component curve analysis for analyzing data from a computer-assisted-instruction situation.

Theory

General

The first step in the statistical analysis of a set of data is the specification of a theoretical model. This is true regardless of whether one is using analysis of variance, regression analysis, or factor analysis. The choice of a particular model is dependent upon relevant theory, previous research, and practical considerations. Because of the complexity of the computations and because of a desire for a "simple" model, a linear model is often postulated.

A linear model as used in classical factor analysis is given by

$$Z_{ji} = a_{j1}F_{1j} + a_{j2}F_{2i} + \ldots + a_{jm}F_{mi} + a_jU_{ji}$$

where:

Z_{ji} represents the standard score for person i on test j

a_{jm} represents the factor loading for test j with common factor m

F_{mi} represents the factor score on factor m for person i

a_j represents the factor loading for test j with unique factor j

U_{ji} represents the factor score for person i with unique factor j.

This model is commonly used when studying the abilities that characterize the behaviour of a group of subjects. Thus variables such as verbal ability, spatial ability, general reasoning ability, etc. are usually defined in terms of factors derived from an analysis of the correlation matrix of test items. A subject's observed score is then represented as a weighted sum of these unique abilities.

The algebraic expression may be expressed more compactly using matrix notations.

$$_nZ_N = [A \vdots a][f \vdots u] = Af + au$$

$$= {}_nM_{m+n}\ {}_{m+n}F_N \text{ where:}$$

n = number of tests

N = number of subjects

m = number of common factors

Since the correlation matrix, R, is equal to ZZ'/N,

we have $R = MFF'M'/N = M\Phi M'$, where $\Phi = FF'/N$.

Notice that Φ is the correlation matrix between the factors.

In the special case where the factors are orthogonal, $\Phi = I$ and hence $R = MM'$. Thus an orthogonal solution consists of decomposing the correlation matrix into two matrices M and M' such that $MM' = R$.

In most cases the investigator is interested, not in reproducing R exactly, but in estimating R by $\hat{R}$ using only m ($m < n$) common factors. In this case, we have:

$$\hat{Z} = Af$$

from which we have:

$$\hat{R} = Aff'A'/N = A\Psi A' \qquad \text{where } \Psi = ff'/N.$$

Once again, a solution is orthogonal if $\Psi = I$, implying $\hat{R} = AA'$.

It is of interest to note that there are an infinite number of matrices A such that $\hat{R} = AA'$.

A more general approach, which need not be used with just a correlation matrix, has been provided by Eckart and Young (1936). They have developed a method for approximating, in a least squares sense, any matrix X, such as a set of scores, by a matrix $\hat{X}$ obtained from any specified number of factors.

The Eckart-Young analysis of the data matrix X is given by the equation:

$$_nX_N = {}_nV_n\ {}_nG_N\ {}_NW_N$$

where V is an orthogonal matrix ($V' = V^{-1}$)

W is an orthogonal matrix ($W' = W^{-1}$)

G contains the eigenvalues, λ_k in the diagonal elements of the upper left section and zeros elsewhere.

This work forms the basis for analyzing the component curves. When the scores in the X matrix represent learning data, then the V matrix reflects a set of learning curves and the W matrix tells us something about the individual's behaviour relative to these curves.

Tucker's Approach

The matrix $\hat{X}_k$ approximating the score matrix X, is formed by using the first k left principal vectors, (cols) in V, principal roots in G, and right principal vectors (rows) of W to form the matrices V_k, G_k, W_k such that

$$_nX_{k\,N} = {}_nV_{k\,k}\,{}_kG_{k\,k}\,{}_kW_{k\,N} \qquad (1)$$

Tucker defines the matrices,

B^*_k and Y^*_k as follows:

$$B^*_k = N^{-\frac{1}{2}}\ V_kG_k \qquad (2)$$

$$Y^*_k = N^{\frac{1}{2}}\ W_k \qquad (3)$$

where $N^{\frac{1}{2}}$ is a scaling factor to ensure that the mean square of each row of Y^*_k is unity.

Thus

$$\hat{X}_k = B^*_k\ Y^*_k \qquad (4)$$

Recalling that X = VGW,

therefore XX' = VGWW'G'V'

= VGG'V'

= VG^2V'

This equation can be solved using the familiar Hotelling principal axes algorithm. The number of principal roots and vectors may be determined by inspection and B^*_k is easily computed using equation (2).

Since $B^*_k\ Y^*_k = \hat{X}_k$,

pre-multiplying both sides by $B^{*\prime}_k$ yields

$$B^{*-1}_k\ B^*_k\ Y^*_k = B^{*-1}_k\ \hat{X}_k. \qquad (5)$$

Also,

$B^*_k = N^{-\frac{1}{2}}\ V_kG_k$ (see equation (2)).

Therefore

$B^{*\prime}_k = N^{-\frac{1}{2}}\ G_k'\ V_k' = N^{-\frac{1}{2}}\ G_k\ V_k'$.

Substitution into equation (5) gives

$(N^{-\frac{1}{2}}\ G_kV_k')\ (N^{-\frac{1}{2}}V_kG_k)\ Y^*_k = B^{*\prime}_k\ \hat{X}_k$

$N^{-1}\ G_kV_k'V_kG_kY^*_k = B^{*\prime}_k\ \hat{X}_k$

$N^{-1}\ G^2_k\ Y^*_k = B^{*\prime}_k\ \hat{X}_k$

$Y^*_k = NG^{-2}_k\ B^{*\prime}_k\ \hat{X}_k$

Since the first k eigenvalues and eigenvectors of X are identical to those of $\hat{X}_k$, the known data matrix X is substituted for $\hat{X}_k$, giving us the solution

$$Y^*_k = NG^{-2}_k B^{*'}_k X \quad (6)$$

where all terms on the right hand side of (6) are known.

The Eckart-Young procedure shows that if $\hat{X}_k = B^*_k Y^*_k$ then $\Sigma\Sigma(X_{ji} - \hat{X}_{ji})^2$ is a minimum for the selected k, i.e., errors are minimized, where B^*_k may be interpreted as the factor loading matrix

Y^*_k may be interpreted as the factor score matrix.

This model may be interpreted as follows, "the series of scores of an individual is a weighted sum of reference learning curves, the weights being the individual factor scores and the series of b's for each factor forming a reference learning curve (Tucker, 1966, p. 483)."

Unresolved Issues

There are at least three decisions that must be made by the experimenter who decides to use a component curve approach:

1. Selection of data matrix for analysis.
2. Number of learning curves to be considered important.
3. How to rotate the axes to obtain meaningfully important learning curves.

The answers to all three questions are presently dependent upon the context of the particular study in question. This will be illustrated in the example which follows. The theory of factor analysis does not, at least at the current stage of development, provide answers to these questions.

The remainder of this paper will be devoted to an examination of the above methodology as it might be applied to an analysis of student performance in a computer-assisted instruction situation.

Example

Method

Tucker's validation of the component curve analysis was based on a sample of 24 subjects on a series of 21 learning trials. The present study had 20 subjects but had only a series of 5 learning trials.

The subjects were volunteers from a class in Ed. Psych. 271 at the University of Alberta and consisted of first year undergraduate students. Initially 32 subjects participated in the study, however, only 20 of these were used for the present analysis. Four subjects were excluded because they were absent for one of the two trials and eight subjects did not satisfy the minimum criteria of interacting with the simulation exercise for at least five decision periods or 'years'.

The program which was used in this study simulated the operation of a large lumber company. The student played a role of manager of this company. He had direct control over the amount of money he wished to invest in the lumber mill, his investment in machinery (an aggregate value which covers trucks, chain-saws, and spare parts), and the amount of money he wished to borrow from a loan company. He also controlled the number of employees on the payroll, the area he wished to reseed with young seedlings, and he could set an upper limit on the area to be cut during the coming year.

The student was required to use a light pen to point to the variable—say staff—which he wished to change. He was then required to type in the amount corresponding to this change. All students were familiar with the terminals and the setting before actually using the simulation program.

After the student had made his policy decisions, the computer calculated the effect of these decisions and automatically displayed the results on the screen. It calculated cash on hand, value of sales, and value of total assets. It also showed the amount of land that was now cut over and barren, land under reforestation, and land containing harvestable timber. The values of the mill and machinery were adjusted to reflect depreciation. The student then made a new series of management decisions for another "year", and the process was repeated.

The computer system automatically maintained a performance record of the responses of each student. Thus, values of all variables, including latency times were known for each decision made by the student. Performance records were printed out after the student had completed his session, and the values of the relevant variables were used in the construction of graphs and in the statistical analysis.

TABLE 1
FOREST SIMULATION RAW DATA: ASSETS ($) FOR FIVE TRIALS BY EACH OF TWENTY SUBJECTS

Subject	Trial[1]				
	1	2	3	4	5
1	358.7	357.2	347.1	333.9	318.5
2	388.7	382.4	376.1	368.4	361.8
3	417.0	458.8	498.2	518.3	556.5
4	361.7	356.9	363.1	351.0	358.8
5	377.2	368.2	347.2	334.9	307.2
6	376.2	374.6	376.0	370.5	359.9
7	373.5	408.7	464.5	585.4	775.9
8	365.4	350.7	336.6	319.6	299.6
9	355.2	388.0	540.9	673.5	782.7
10	365.4	346.6	325.6	307.9	278.7
11	371.6	361.4	348.7	328.5	200.6
12	396.4	395.2	388.9	390.9	397.2
13	370.4	376.6	379.9	377.9	373.9
14	394.2	421.5	484.0	567.0	673.6
15	375.7	355.9	337.1	289.4	234.6
16	359.8	348.2	334.6	327.3	318.7
17	365.5	389.5	411.9	428.6	449.7
18	376.3	424.7	466.9	519.3	585.1
19	384.2	383.2	413.8	439.9	467.7
20	355.2	337.7	317.0	293.8	248.1

[1] A learning trial is defined as one 'year' of decision making for running the lumber company.

Analysis

The raw data for each individual (Table 1) consists of the value of the "assets" variable over the number of years, or trials, of operation. The value of assets reflects the values of cash, mill, land cut, land re-seeded, land available for cutting, and machinery and thus represents a composite of all the variables in the model.

Ross (1964) discussed the difference in factor structure resulting from the factorization of correlations, covariances, and cross products and recommended the use of cross products for factoring learning data since this method retains information on both means and variances. This suggestion was followed in the present study since such information represents an important feature of the data.

Tucker used two methods for determining the number of learning curves required to account for the data. The first method uses mean square ratios similar to the variance ratios used in analysis of variance. A test similar to that used in analysis of variance is used to determine the number of learning curves. Using the formulae provided by Tucker the five mean square ratios in Table 2 were computed:

TABLE 2
MEAN SQUARE RATIOS FOR COMPONENT CURVE ANALYSIS

Factor	df_1	df_2	Mean Square Ratio	$F_{.99}$
1	24	76	158.6	2.4
2	22	54	78.8	2.5
3	20	34	7.0	2.7
4	18	16	2.7	3.2
5	16	0	0	

Investigation of the above results suggests that three components should be retained.

Tucker's second criterion for determining the number of components is based on the concept of external validity. Thus if a learning component curve is to be considered meaningful (i.e. it represents a consistent learning behaviour instead of a fluctuating random behaviour) it should form a smooth curve. The left characteristic vectors were graphed for the first four components. The first two components satisfied this criterion whereas the last three showed increasing random-like fluctuation. Therefore taking both criteria into consideration it was decided to retain three components. In effect, to reproduce the original learning scores over the 5 trials the weighted sum of the 3 curves would be necessary.

The next step of the analysis obtains the loadings of the trials on the component curves. The results of this step are provided in graphical form (Figure 1).

An examination of the three unrotated components leads to the following three observations:

(1) Component 1 has an initial high value and increases steadily at a slow rate over 5 trials.

(2) Component 2 has an initial very low value and increases rapidly over 5 trials.

(3) Component 3 has an initial low value and shows a slight fluctuation over 5 trials.

Thus it is possible to interpret component 1 as representing sure steady performance, component 2 as representing initially poor performance but able to profit by mistakes, and component 3 as representing consistently poor performance.

The last step involves solving aquation (6) for Y^*_k to obtain the weights for each individual on each learning curve, thus indicating the extent to which his learning follows each of the learning curves. The results are given in Table 3.

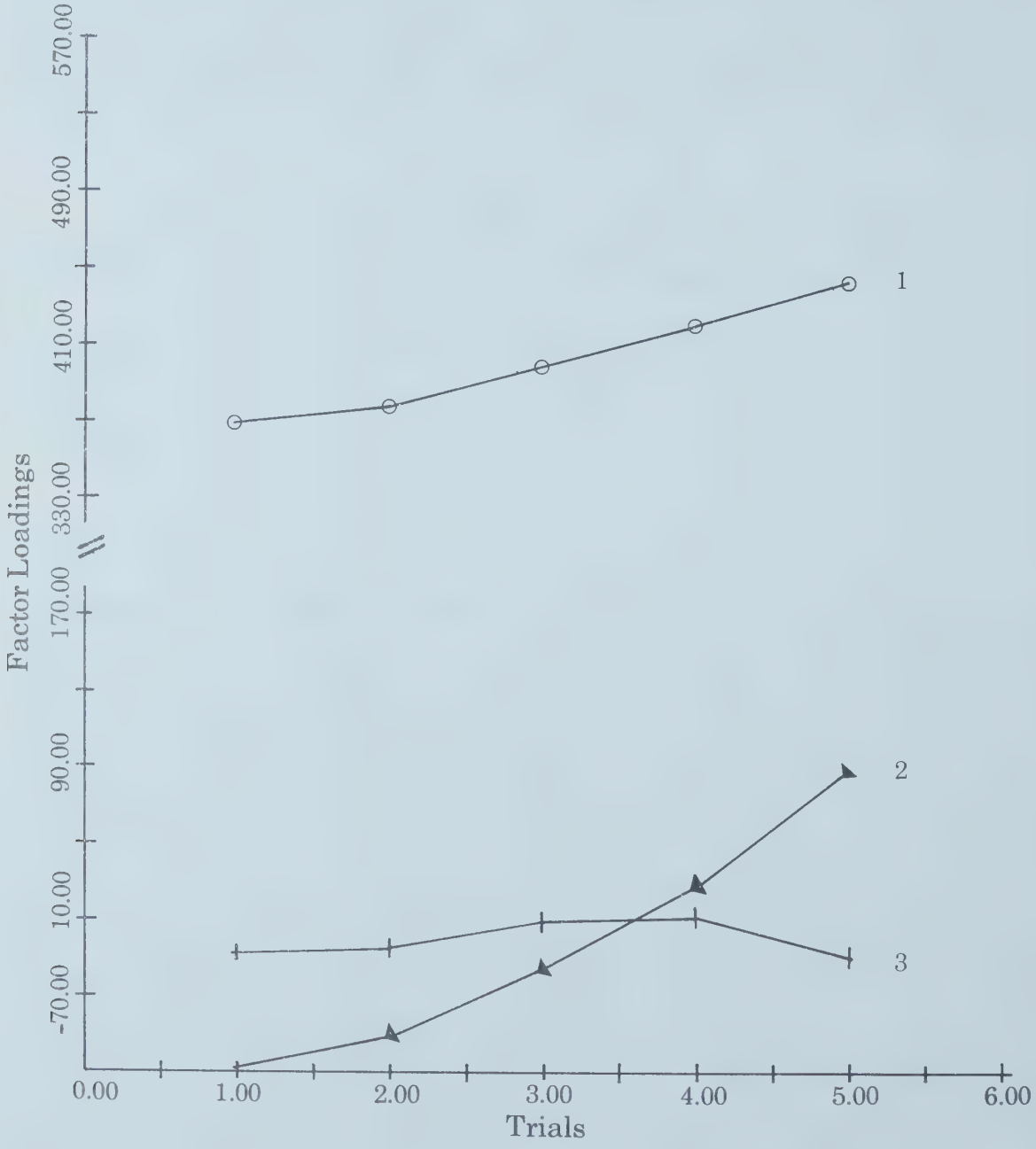

Figure 1. Factor loadings of trials on three component curves.

The last remaining issue is that of rotation. There are two principal reasons for rotating the axes:

(1) to enhance the meaningfulness of the learning curves, and
(2) to provide maximum separation among the subjects.

At present there are no firm guidelines as to what constitutes a meaningful or desirable rotation. Tucker considered the criterion of simple structure in the trial space but rejected the idea on theoretical grounds—he was unable to justify why one would want many zeros in the component curves over trials. He also looked for simple structure in the person space to see if individuals followed different component curves but the results were negative. He finally used a graphical procedure for rotation

TABLE 3

FACTOR SCORES OF TWENTY SUBJECTS ON UNROTATED COMPONENTS

Subject	Component		
	1	2	3
1	0.850	-0.687	-0.231
2	0.931	-0.615	-0.426
3	1.225	0.244	0.674
4	0.890	-0.451	-0.404
5	0.858	-0.854	-0.372
6	0.922	-0.543	-0.006
7	1.320	1.967	-2.378
8	0.827	-0.805	-0.477
9	1.389	2.229	2.481
10	0.802	-0.918	-0.516
11	0.791	-1.415	2.347
12	0.978	-0.465	-0.630
13	0.934	-0.437	0.035
14	1.279	1.215	-0.370
15	0.783	-1.282	0.048
16	0.837	-0.651	-0.654
17	1.021	0.022	0.334
18	1.191	0.721	0.329
19	1.043	0.080	-0.005
20	0.765	-1.033	-0.084

that is used sometimes in factor analysis where abilities are being studied, namely such that all component curves had non-negative entries, non-negative slopes, and that they all reached an asymptote.

In order to provide more data on this issue it was decided to investigate the criterion of simple structure in either the trial or person space. At present the restriction to an orthogonal rotation appears desirable since this ensures the independence of components. It is possible that oblique rotations will come into use at a later date after more development with the procedures has taken place. Three procedures for an orthogonal rotation to a simple structure criteria were used: quartimax, varimax, and equamax.

A simple structure in the trial space could be interpreted as follows: at different stages in the learning situation a single component adequately describes the variation in performance. For example, component 1 might account satisfactorily for the data on the first two trials, component 2 for the third trial, and component 3 for the last two trials. The results of the three rotations to the present data were negative—there was no evidence of simple structure.

A rotation in the person space involves applying an orthogonal transformation to the factor score matrix. A simple structure in this situation could be interpreted as showing that certain individuals follow a unique component. The quartimax rotation gave the best results. Seventeen of the twenty students could be identified with a single component. The graph of the quartimax rotation is given in Figure 2 and the rotated factor score matrix for the quartimax given in Table 4.

TABLE 4
FACTOR SCORES OF TWENTY SUBJECTS AFTER QUARTIMAX ROTATION IN PERSON SPACE

Subject	Component		
	1	2	3
1	1.104	0.108	-0.072
2	1.183	0.102	0.133
3	0.509	1.303	-0.238
4	1.043	0.173	0.201
5	1.264	-0.050	-0.056
6	1.000	0.340	-0.170
7	0.441	0.796	3.231
8	1.244	-0.097	0.053
9	-1.186	3.365	-0.569
10	1.310	-0.193	0.017
11	0.724	0.936	-2.595
12	1.185	0.114	0.390
13	0.929	0.425	-0.142
14	0.261	1.349	1.167
15	1.350	-0.125	-0.650
16	1.209	-0.094	0.285
17	0.609	0.877	-0.115
18	0.292	1.366	0.306
19	0.694	0.758	0.197
20	1.221	-0.068	-0.404

Referring to Table 4, it may be noted that twelve students (1, 2, 4, 5, 6, 8, 10, 12, 13, 15, 16, 20) have a high factor score on component 1, three students (3, 9, 18) have a high score on component 2, and two students (7, 11) have a high score on component 3. The remaining three students (14, 17, 19) have high factor scores on two of the three com-

ponents. These results of rotation in the person space are encouraging, and should lead to a clearer examination of individual differences.

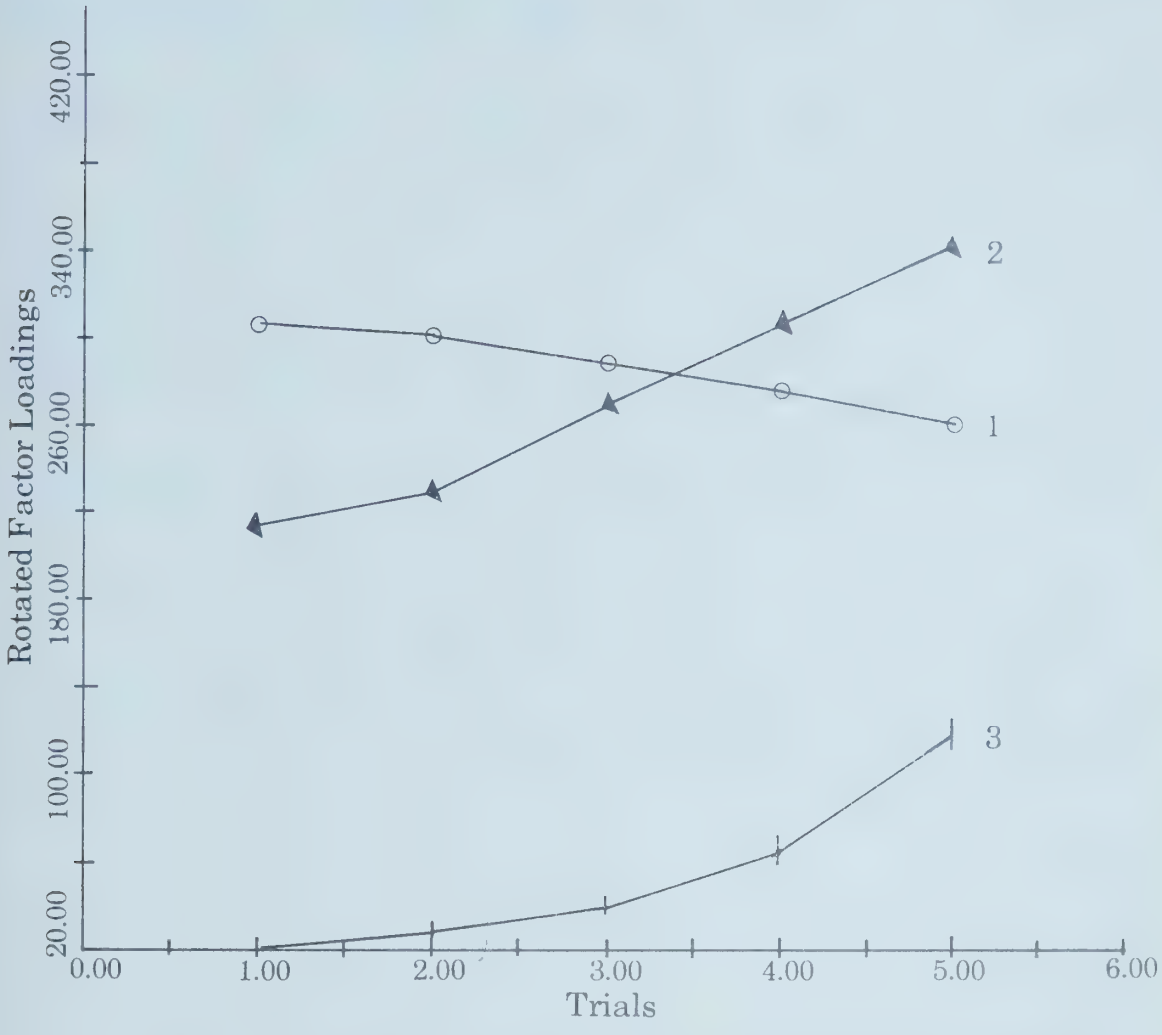

Figure 2. Factor loadings of trials on curves after quartimax rotation.

Conclusion

The present study has illustrated the suitability of Tucker's component curve analysis for looking at a new development in education—that of using simulation games and models as a method of instruction. Furthermore it brings into focus the issue of individual differences and since three learning curves are required to account for the learning data, it shows the unsuitability of a generalized mean learning curve for summarizing data in this type of situation.

It is recommended that subsequent studies include a number of independent external measures for each subject. This should aid in the identification and interpretation of the respective components (rotated or unrotated). This will also provide important links with the existing body of knowledge in the field of learning theory.

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BOOK REVIEWS

STUDENTS' ATTITUDES AND COLLEGE ENVIRONMENTS

By J. McLeish, Cambridge Institute of Education, in Association with The University of Alberta, 1970. Pp. vii and 251.

Dr. McLeish joined the staff of the Department of Educational Psychology, University of Alberta, in 1969. Previously he had been Research Fellow at the Cambridge (England) Institute of Education which is an association of about a dozen colleges for the training of teachers in Cambridge and the surrounding area. This monograph reports one of his main research activities, namely, a survey and analysis of the attitudes to education, the values and certain personality characteristics of different groups of student teachers, and the changes—if any—brought about by their course of training. Virtually the whole intake of 1,671 students (in 1965) was included, and nearly 90 percent of them took the same tests again 2 or 3 years later. Some 1,500 other persons filled in all or most of the tests. Though mainly educationists, they ranged from Prison Officer tutors to Hawaiian-Japanese students, and from nurses to school dentists. Indeed this was a mammoth exercise to be undertaken almost singlehanded by the author, his wife, and a computer.

The results as such will be of less interest than they might be to Canadian readers because many of the categories of English students will be unfamiliar; and there is nothing in North America quite corresponding to the English residential training college (nowadays dignified by the title College of Education), which chiefly trains non-graduate teachers. It is unfortunate, too, that the very small numbers of men in the main sample (130) make the results on sex differences nugatory. Nevertheless many aspects of the methodology, and the tests used, are worth the attention of anyone concerned with large-scale attitude surveys.

A rather short chapter summarizes the literature on changes in student attitudes, and there is a bibliography of 430 titles. Special attention is given to the work on attitudes to educational issues carried out at Manchester under Professor Oliver. The author points out that many of the published studies consist of cross-sectional investigations, and also that control groups are conspicuously lacking. He was able to separate out the changes attributable to training college courses by contrasting his students with students of nursing, whose attitudes over the same length of time were relatively stable.

The study began with semi-structured interviews with 61 advanced students, designed to provide varieties of opinions about educational matters. However the taped material proved so difficult to analyze that Dr. McLeish eventually decided to use published tests (with minor modifications), including Oliver and Butcher's educational attitude scales, Eysenck's MPI and social attitudes scale, and other tests of values, job satisfaction, etc.—a total of 31 variables. All of these are given in the Appendix in full, and should be of considerable use to other investigators. Additional pilot work was done with 300 written educational autobiographies. Attempts to reduce these to quantitative indices by rating the

attitudes that they portrayed proved too time-consuming and too subjective. One might question, though, whether modern techniques of content analysis of such open-ended material might not have yielded more usable data.

Further work was done on the assessment of college characteristics, both by combining objective indices (e.g. proportion of male staff), and by student ratings. Wide differences in 'climate' between the ten participating colleges were revealed, though the objective and subjective approaches often failed to agree. It proved possible to link some of the differences in ratings to differences in the raters' own attitudes or values. For example, the lecture method was generally unpopular, but it was approved more often by the more stable and generally conservative students.

The major finding is that the students' social and educational opinions tended to become more progressive, more humanistic in the course of their training, and less dominated by narrowly religious views. On the other hand changes in personality and values were relatively slight. These and other conclusions are fully documented and lucidly explained. One might, however, add a mild criticism that so much space is taken up with details of the scores of various sub-groups and other non-college groups. Naturally there are differences which are often plausible and revealing. But, as in most survey studies, one gets very little out of descriptive data which were not collected on the basis of preformulated hypotheses.

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LIBRARIES AND EDUCATION

By Cecily Brown. Quarterly Review of Australian Education, *September 1970. Melbourne, Australian Council for Educational Research, 69 pp.*

Miss Brown, who has had experience in university, public and state libraries, is Librarian-in-Charge at A.C.E.R. and is Editor of the *Australian Education Index.* She is thus well fitted by experience, position and opportunity to comment upon libraries and education. Her report gives a brief, well-balanced and up to date, though in parts superficial, introduction to the problems facing libraries in Australia.

The report is obviously too short to do else but highlight obstacles to libraries fulfilling their full educational potential. The main requirements are adequate finance for planned and effective growth, the need for increasing numbers of trained librarians and, in the schools, a need for State Departments of Education to revise the method of providing, staffing and utilizing school library facilities.

In her report, Miss Brown devotes most of her attention to School Libraries (21 pp.) and to Teachers' College Libraries (17 pp.) for it is

in these two areas that students' and, subsequently, teachers' attitudes towards libraries as educational facilities are established. But the problems of school libraries are more complex than indicated. For example, libraries are often ineffective in new schools for many years because inadequate planning of the establishment phase compels them to start from small beginnings. Teachers and students are thus obliged to rely heavily on text books alone. In 1947, McColvin[1] commented adversely on this aspect of library policy, apparently with little result.

School libraries are staffed by teachers with only a smattering of library training. As teacher/librarians, most are attached to English departments in secondary schools and all are required to demonstrate teaching skill for promotion purposes. This often means that they will teach a class in English for a certain time each week. Their library duties, for which they are allowed two hours per week, thus assume lesser importance, for promotion is not possible solely as a librarian.

This policy affects the provision of library services and the attitude of students and teachers to the library as an educational facility. Students and teachers, alike, regard "Library" as a subject and the responsibility of the librarian, while the use of the library as a classroom limits its general availability to a fraction of the week. Teacher librarians also act as substitute teachers, further diminishing their ability to provide library services. The need to replace inadequately trained teachers with fully trained librarians would appear to be self evident, but strong interests within the Departments resist such changes.

Shire and Municipal libraries, which provide special services to develop children's reading interests, and provide general reading and educational material, receive little attention in this report. In many areas, such libraries often compensate for school library services during out-of-school hours. Although not trained as teachers the librarians' provision of materials and services of interest to children has been of a high order.

Data on increasing library expenditures, and the apparent decline in the belief that libraries represent "educational frills", provide a heartening prospect that Australian libraries are, at last, emerging from the era of apathy and indifference.

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[1] *Public Libraries in Australia*, Melbourne, M.U.P., 1947.

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